

THE LARYNGOSCOPE.

VOL. LII

JUNE, 1942.

No. 6

A CLINICAL SURVEY OF THE SPHENOID SINUS. WITH SPECIAL REFERENCE TO THE DIRECT METHOD OF LAVAGE AND INJECTION OF OPAQUE MEDIUM.*†

DR. J. C. PEELE and DR. F. E. LEJEUNE, New Orleans.

The problem of headache and its frequently associated symptoms even when confined to the limits of nasal origin is frequently a perplexing one, and its solution may tax the ingenuity of the most competent physician. Pain of sinus origin is due to stimulation of the trigeminal nerve. The wide distribution of this nerve, and its frequent and extensive anatomic variations in the sinuses, help to explain why it is that headache may be so severe and deceptive. Recently it has become popular among laymen to consider discomfort in the head as being "sinus trouble." Even we as otolaryngologists, working as we are in a restricted field, are perhaps too prone to adopt a limited view as to the etiology of these manifestations and to ascribe to them a rhinologic origin, whereas they may actually be due to another system of the body undergoing pathologic change.

The rôle which the sphenoid sinus plays in the production of symptoms referable to the ear, nose and throat is a dominant one, although it is frequently not immediately obvious. The capacity which disease of this sinus has to mimic pathologic states of the other paranasal sinuses and the character-

*From the Department of Otolaryngology, Post-Graduate School of Medicine, Tulane University, and the Eye, Ear, Nose and Throat Hospital, New Orleans, La.

†We are indebted to Dr. W. H. Gillentine for making the general physical examinations and to Dr. Howard H. Russell for conducting the allergic studies. Dr. E. R. Bowie and Dr. E. C. Samuel interpreted the Roentgenograms. Dr. George H. Hauser made the pathologic studies.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 1, 1942.

istic marked obscurity of its symptomatology are facts too well known to emphasize here. The marked characteristic asthenia sometimes found in the postinfluenzal state has frequently been identified with a persisting suppurative sphenoiditis. This latter relationship was brought to our attention very forcibly in March, 1940, by an influx of patients into the clinic of the Eye, Ear, Nose and Throat Hospital in New Orleans. These patients had exposed themselves unduly during the inclement weather attending the festivities of the Mardi Gras period and were stricken with the disease commonly recognized as influenza, which was mildly epidemic at that time. Many of this group complain bitterly of symptoms which made us suspicious of sphenoidal sinus involvement, and later we were able to prove this relationship. During the course of this investigation we became deeply intrigued by the problems concerned in the diagnosis of sphenoiditis, and we were led to undertake a clinical survey along these lines during the period from March, 1940, to July, 1941.

Plan of Procedure: The patients comprising this group were all carefully selected because of a chain of symptoms and certain signs within the nose and throat which immediately focused attention on the sphenoid sinuses as the source of trouble. Of this group, we studied and injected the sphenoidal sinuses with opaque medium in a total of 97 patients. Of this number, 75 were sufficiently studied to be included in this series. The vast majority of these patients had received treatment intermittently in the clinic for from one to six years, and most of them were in a state of chronicity. A careful history was taken, and an examination of the ear, nose and throat was made. The usual routine Roentgenograms were made, although an average of one to five X-ray examinations had been made at some time previously. The sphenoidal sinuses were then catheterized by the direct method, lavaged and the washings sent to the laboratory for routine study. From four to seven days later, an opaque medium was introduced by means of syringe and cannula and a special set of Roentgenograms made. Wassermann and Kahn tests of the blood were made routinely. All patients were examined for pathologic changes of the ocular fundi and for the presence of central color scotoma. Routine visual fields were taken. General physical examinations were made and allergic studies conducted. The plan of therapy was outlined according to the status of the individual case.

Technique of Catheterizing the Sphenoidal Sinus: The Direct Method of Lavage and Injection of Opaque Medium — The nose is first shrunk with any suitable shrinking solution and carefully anesthetized by means of any appropriate local anesthetic. Anesthetization of the region of the sphenoidal ostium should be made slowly and thoroughly. A Ludwig fine applicator with a slight lateral curve in the anterior third is tipped with a piece of cotton and introduced to the face of the sphenoid along Zukerkandl's line. By careful palpation the ostium is located and the applicator introduced to the posterior wall of the sinus, where it is allowed to remain in place for about five minutes. The distance from the columella to the posterior wall is measured and recorded. The patient is then placed in the recumbent position and a five-inch silver cannula, which has been bent to conform to the curve of the applicator, is introduced into the sinus, following which the patient's head is extended so as to bring the cannula into a vertical plane. By means of a sterile syringe and desired solution the lavage is made. Frequent churning of the solution in the sinus is essential.

The introduction of opaque medium is accomplished in the same manner and the patient allowed to sit or stand for five to 10 minutes with the head fully extended. This position with occasional swallowing during the time, allows all solution to drain away from the nasopharynx and sphenoidal recesses. Solutions introduced into the sinus should be warm, and it is best not to precede the injection of radiopaques by lavage. The opaque media which we have employed in this study include iodochlorol, theridol, brominol, lipoiodine diagnostic and colloidal thorium dioxide.

In employing this technique we were able to catheterize the natural ostium in about 75 per cent of selected cases. In some instances it was necessary to displace the middle turbinate laterally, and in three cases a submucous resection of the septum had to be done before the sinus could be entered. On some occasions when the natural ostium could not be found, we lavaged the sinus according to the method of Tremble,¹ using his newly devised sphenoid cannula. Cannulae of this type used in this method of lavage were previously devised by Lobell,² Spielberg³ and others. The method is safe if properly employed. We had no serious complications from

the direct method of catheterizing the sphenoid sinus for diagnostic lavage and injection of opaque medium.

The Relative Value of Certain Opaque Media in the Roentgenography of the Sphenoid Sinus: The use of a radiopaque as an aid in the diagnosis of sinusitis is a matter of routine procedure with the otolaryngologist today. Following the pioneer work of Reverchon and Worms in injecting the antrum with an opaque medium, impetus to this phase of sinus diagnosis was given by the work of Fraser,⁴ Proetz,⁵ Mac Cready⁶ and Goodyear⁷ in this country. Lobell⁸ was among the first to inject an iodized oil into the sphenoid. We employed the



Fig. 1. Granger position showing extensive pneumatization of the pterygoid process in a patient with Vidian neuralgia. Opaque medium: Iodo-chlorol.

radiopaque substances previously mentioned in our study, and we would like to add a brief word of comment as to their relative value. We found them all to be satisfactory, but some of these substances possessed especially desirable qualities. It should be remembered that this work was limited to the sphenoid sinus.

Iodochlorol (Searle) (see Fig. 1) — This radiopaque contains 27 per cent iodine and 7.5 per cent chlorine organically combined with a highly refined peanut oil. We found it to be stable, nontoxic and nonirritating. It was employed in both the pure and diluted state, but the latter was preferable. When diluted with an equal part of olive oil, the resulting solution made an ideal radiopaque, and it is possible that even

greater dilutions may be entirely satisfactory. The radiopacity of this substance was good, it was injected into the sinus with a fair degree of ease, and there were no untoward effects from its use.

Theridol (Lilly) (see Fig. 2) — This is a chloriodized oil which contains 17 to 19 per cent iodine with a specific gravity of 1.13. It was intended by the makers to be used primarily as a therapeutic agent in the tracheobronchial tree. We found



Fig. 2. Hirtz position showing an unusually large sphenoid sinus (total content: 22 cc.) with pneumatization of the great wings. Opaque medium: Theridol.

it to be stable and nonirritating and there were no undue effects from its use in the sphenoid sinus. Because of the low iodine content the radiopacity was not especially pronounced, but we found it to be entirely satisfactory for sinus work. Because of its low viscosity it was injected into the sinus with relative ease, and this is a particularly desirable feature.

Lipiodine Diagnostic (Ciba) (see Fig. 3) — This medium represents a solution of lipiodine in sesame oil containing about 24 per cent iodine. Lipiodine is the trade name for the ethyl ester of diiodobrassicic acid. It solidified at a temperature below 67° F., but readily liquefied at a higher temperature. The radiopacity was good, it was easily injected, and there were no complicating effects.

Brominol (Abbott) (see Fig. 4) — This product was available in both the light and heavy forms, the bromine content of both being 33 per cent. "Brominol light" is a brominized olive oil and "brominol heavy" is a brominized olive oil ester. The light form did not have sufficient viscosity to be ideal when used alone, and "brominol heavy," because of its extreme viscosity was not suitable for sinus work; however,



Fig. 3. Rhese position showing pneumatization of the optic canal. Opaque medium: Lipiodine Diagnostic.



Fig. 4. Granger position showing bilateral hyperplasia of the sphenoid. Opaque medium: Brominol Light.

by combining the two products, a solution of any desired viscosity was produced that in every way was suitable for injection in the sphenoid sinus. The pleasant aromatic odor is an additional advantage. We employed mixtures of equal parts of each type and mixtures containing three parts of the light type with one part of the heavy with success.

Colloidal Thorium Dioxide (Heyden Chemical Corp.) (see Fig. 5) — This opaque substance (Thorotrast, Umbrathor) is

a colloidal solution containing 25 per cent thorium dioxide with a pH of 2.8. It was recently used by Grove³ as an opaque medium in the antrum, and we found it to be satisfactory for outlining the sphenoid sinus. Its radiopacity was good and its low viscosity facilitated injection. We did not lavage the sinus subsequent to its use and there were no untoward effects. With solutions of this viscosity we found it best to let the patient stand or sit with head fully extended not more than two or three minutes instead of the usual five to 10 minutes following the installation of opaque oil. This is of some advantage.



Fig. 5. Hirtz position showing extension of left sphenoidal sinus behind posterior wall of the right sinus. Opaque medium: Colloidal Thorium Dioxide.

Methods for Determining the Intranasal Distance to the Sphenoid Sinus: There are certain valuable measurements relating to the sphenoid which are of practical significance to the surgeon who is undertaking a lavage or operative procedure. The usual method described in the textbooks of recording the distance between the anterior nasal spine and anterior wall of the sphenoid is not the most desirable. The former is not easily accessible in the living, and as to the latter we are more concerned with determining the anteroposterior extent of the sinus than the distance to the anterior wall. After placing a probe through the ostium to the posterior sinus wall, the distance from the columella may be measured directly. This method, and also the method of X-raying the sinus with a probe in place, has some limitations. Not infrequently the presence of a septal deflection

or the enlarged posterior tip of the middle turbinate, or both, make it imperative to impart a marked lateral curve to the probe or applicator, with the result that the tip contacts the lateral and not the posterior wall. Such a measurement may be misleading. By measuring the distance on an applicator placed within the sinus we found the average distance from the columella to the posterior wall of the sphenoid to be 9.29 cm. for the right and left sides in the adult male, and 8.92 cm. for the right and 8.94 cm. for the left in the adult female. In several children between the ages of 8 and 12 years the average distance was 8.05 cm. for the right and 7.85 cm. for the left. The average oil content of the sinus



Fig. 6. Hirtz position showing a sphenoid sinus of average size in the adult female. Total content: 10 cc.

was 5.11 cc. for the right and 6.47 cc. for the left in the adult male, and 5.01 cc. for the right and 6.17 cc. for the left in the adult female (see Fig. 6). In the children the average oil content was 2.85 c.c. for the right and 3.4 c.c. for the left (see Fig. 7). The maximum capacity for a single side in the adult was 14 c.c., while the maximum total capacity for both sinuses was 22 c.c. (see Fig. 2).

Etiology: Both local and general factors played a part in the etiology of sphenoiditis, and frequently were inter-related. We encountered the usual run of intercurrent disease and avitaminosis to be expected in clinic practice. Septal deflections, enlarged turbinates, polyps and other factors prevailing within the nasal cavity served their purpose in interfering with the normal ventilation and drainage of the sinuses.

The anatomic variations of the sphenoid sinus itself played a very definite part in the etiology of sphenoid disease, and we would like to emphasize this point. The small infantile type of sinus, usually associated with a similar condition in



Fig. 7. Granger position showing sphenoid sinus in a child age 12 years. Total content: 6 cc.



Fig. 8. Hirtz position showing marked disparity in size of sphenoids. Lavage of small sinus repeatedly showed pus. Returns from large sinus clear.

the ethmoids, was especially prone to infection and chronicity. In the literature we found the oft repeated statement that when a marked disparity in size exists between the two sinuses it is the larger which is more likely to be infected (see Fig. 8). We would like to add a word of caution about accepting this statement without question, since we encoun-

tered a number of instances in which the reverse was true. Pneumatization of the pterygoid processes, palate bone, clinoid processes, greater and lesser wings of the sphenoid and the basilar portion of the occipital bone, and the presence of accessory septa within the sinus cavity, make for a condition which is not conducive to rapid healing of inflammatory processes (see Figs. 9, 10, 2 and 3). Small and highly situated



Fig. 9. Granger position showing bilateral pneumatization of the anterior clinoid processes.



Fig. 10. Granger position showing bilateral pneumatization of the pterygoid processes.

ostia, or ostia blocked by nasopharyngeal pathologic changes, are factors to be considered. Proetz,¹⁰ however, studied the microscopic anatomy of the sphenoidal ostium and found it to be made up chiefly of nasal elements. He concluded that it is not readily closed except by extreme engorgement of surrounding tissues or by actual hyperplasia.

The part played by environmental factors was of some importance. Some of our patients dated the onset of symptoms or else experienced a definite exacerbation of symptoms following their employ in an atmosphere charged with irritating elements. Allergy played a definite and significant part, and it was of both the seasonal and the bacterial type.

Infections, both local and general, were the chief etiologic agent in our patients. The characteristic feature was the history of head colds and sore throats which gradually became more frequent and severe. In many cases there was clinical evidence to support the conclusion that the anterior group of sinuses were first involved, with infection of the sphenoid taking place at a later date. Influenza played a significant rôle. Some patients who considered themselves to have been previously free of sinus disease ascribed the onset of their symptoms to a prostrating attack of "flu," followed by a marked state of asthenia and a head cold that persisted in spite of remedies. We believe that their symptoms were due in large part to a persisting suppurative sphenoiditis which gradually became chronic. This relationship is not new and was pointed out by European workers as early as 1890.

Syphilis plays both a direct and indirect part in the etiology of sphenoiditis. Luetic involvement of the bone is rare but when present leads to necrosis, dehiscences, sequestration, meningitis and perhaps death, as in the cases reported by Jessop¹¹ and others. In three of our cases the blood Wassermann and Kahn tests were positive. Two of these received regular antiluetic therapy and improved remarkably with only conservative treatment of the sinuses.

The presence of chronic sinusitis in the debilitated state accompanying tuberculosis is a common finding, although actual tuberculous infection of the sinuses is rare. Kernan¹² and Kurzak¹³ reported such infections of the sphenoid.

Druss¹⁴ reported two cases in which there was an inflammation of the sphenoid as the result of infection developing in a patent craniopharyngeal canal. Such a condition might be easily overlooked in the living and also might be confused with Tornwaldt's pharyngeal bursitis. One of our patients presented an infection of the pharyngeal bursa (Tornwaldt's disease).

Tumors of the sphenoid sinus or bone, while not common, are capable of producing trouble in this region. New growths of the body, tuberculum sellae, sella turcica and sphenoid ridge may exert a direct or indirect influence in the production of sphenoid disease. Carcinoma of the sphenoid sinus was described by Davison and Kahr,¹⁵ who stated that only two similar cases were found recorded in the literature by Leon White. Brain tumors or nasopharyngeal growths may indirectly cause a diseased state of the sphenoid.

Symptomatology: There are certain features which we believe to be characteristic of chronic sphenoiditis, and it is our purpose to present them here as we encountered them. It was sometimes difficult to draw a sharp line of distinction between the symptomatology of the chronic suppurative and hyperplastic types, the classical textbook description to the contrary. In general it was found that the duration of symptoms was longer and the symptoms were less severe and less prostrating in the hyperplastic type. Postnasal discharge and the train of symptoms resulting from it was a more constant and aggravating feature in the suppurative type. Eye symptoms were more common in the hyperplastic type of sphenoiditis, and in these hyperplastic cases the pain was more commonly referred to the front part of the head than to the occiput.

Headache: Head pain resulting from sphenoid disease has been attributed to toxemia, rarefaction from vacuum, pressure as a result of swollen mucosa or accumulated secretion, or cranial nerve involvement as a result of the influence of toxins, direct spread of the inflammatory process, or the pressure of hyperplastic bone changes. It may constitute the major complaint of the patient and be so severe and protracted as to necessitate bed rest and sedatives, or it may be entirely absent. We observed a few patients who in spite of a profuse frankly purulent postnasal discharge and large quantities of pus in the sphenoids denied the presence of head pain.

One of the most characteristic types of pain which we encountered was that which began in and around the eye and radiated to the temporoparietal region and occiput. Radiation from the occiput down the back or side of the neck was a common feature, and occasionally pain with this radiation

was felt about the mastoid region. Projection of the pain into the shoulder and arm was not a common occurrence in this group. The presence of pain in the ear and about the mastoid of such a degree as to simulate acute mastoiditis was emphasized by Lyman,¹⁶ Finot¹⁷ and others.

Clinical studies by Sluder¹⁸ and Vail^{19,20} suggested that pain in the locality may be produced by chemical or mechanical irritation of the Vidian nerve in the floor of the sphenoid sinus and relieved by intrasphenoidal applications of cocaine. Vail²¹ proposed several theories to explain the nervous reflex pathways involved in the production of pain in each region of the head, utilizing the Vidian nerve for this purpose. Sauer,²² on the other hand, differed from Vail in that he utilized the maxillary division of the Vth nerve with its connections to explain pain in the side of the head due to sphenoiditis. Reichert²³ showed that severe paroxysms of pain in the ear may result from the so-called tympanic plexus neuralgia, and this should not be confused with reflex otalgia due to sphenoidal infection.

Occipital headache radiating to the vertex, down the neck and occasionally to the mastoid region was a common complaint. Radiation of pain from the neck to the shoulder and arm was sometimes a part of this picture. The relation of sphenoiditis to occipital headache, tinnitus and vertigo was first pointed out by Oaks and Merrill²⁴ and has since been called the "sphenoidal sinus syndrome."

Frontal or supraorbital pain was found occasionally as a reflection of sphenoid disease. The cases of sphenopalatine neuralgia which followed the classical course of the neuralgic component as described by Sluder were observed but were not common. The association of sphenoiditis and Vidian nerve irritation in the production of sphenopalatine neuralgia was first pointed out by Sluder¹⁸ and Bliss²⁵ and later stressed by Vail.¹⁹ Garber,²⁶ however, believes that sphenopalatine neuralgia of sphenoidal origin is due to stimulation of the maxillary division of the Vth nerve, brought about as the result of pneumatization of the greater wings of the sphenoid to close proximity of the foramen rotundum. Since we saw extensive pneumatization of the great wings and pterygoid processes of the sphenoid bone rather frequently, we were forced to conclude that sphenopalatine neuralgia of sphen-

noidal origin may be due to irritation of either the Vidian or the maxillary nerve. Proetz²⁷ stated that unilateral pneumatization of the pterygoid process is present in 20 per cent of cases.

There were certain general features of sphenoid discomfort which were common. The pain was usually of a dull, heavy character but occasionally was sharp and lancinating with a burning quality. It was irregular in time of appearance and lasted varying periods of time. It occurred at times during the night and frequently was present on awakening. Ordinarily, it was only partially relieved by anodynes. Bed rest was frequently necessary. The discomfort was made worse by exercise, stooping, sudden movement of the head, and by alcohol and tobacco.

Nasal Symptoms: Symptoms referable to the nose included nasal obstruction, diminished sense of smell, and occasionally anosmia and parosmia. Head colds were frequent.

Throat Symptoms: Symptoms in this region included postnasal drainage, gagging, retching and hawking, which were usually worse in the early morning soon after arising. Frequent attacks of sore throat were common, and they were usually associated with an exacerbation of the posterior sinusitis. Crust formation was not common. The postnasal discharge varied from scant to profuse and from mucoid to purulent. The manner in which the sphenoid discharges is characteristic when present. As a climax to a slowly developing headache, the patient suddenly feels something open up in the back of his throat, and simultaneously there is a discharge of hot secretion into the nasopharynx, with temporary partial or complete relief of symptoms.

Aural Symptoms: These included fullness, tinnitus, deafness and otalgia. The majority of aural symptoms probably resulted from the chronic inflammatory changes which had taken place in the Eustachian tube as a result of repeated reinfections from the constant postnasal discharge. Sluder,²⁸ however, called attention to the relationship of sphenoiditis associated with pneumatization of the pterygoid process and a low origin of the tensor tympani muscle as a factor in the production of chronic catarrhal deafness.

Ophthalmologic Symptoms: These included blurred vision, photophobia, lacrimation, scotomata, asthenopia, impaired

vision and refractive error. A characteristic feature of the ocular symptomatology was the history of repeated changes in the refractive error, which many patients found necessary to have corrected on a number of occasions within brief spaces of time.

We observed three cases of retrobulbar neuritis. One case was suppurative in character, while two cases were of a hyperplastic nature. The patient showing suppuration and one patient showing hyperplasia obtained relatively rapid relief following the extraction of numerous carious teeth which were associated with extensive pyorrhea. The third patient falling into the hyperplastic group in whom no other focus of infection could be demonstrated was subjected to a bilateral ethmosphenoidectomy with cure of the neuritis.

The relationship of posterior sinusitis to retrobulbar neuritis, in spite of years of work devoted to the subject, is still controversial. Such authorities as White, Gifford, Benedict, Lillie, Sluder, Skillern and others have expressed conflicting opinions as to this relationship. Fisher²⁹ in a recent article gave a brief review of these opinions, and Vail³⁰ cited the outstanding theories which have been advanced to explain the mechanism by which this condition is produced when related to sphenoiditis. He also stated that the symptom of blindness frequently occurs suddenly in the night and expressed the belief that it was due to the gravitation of pus to the upper outer angle of the sinus, where it came in contact with the optic nerve. In our study we noticed a number of cases in which the optic canal was separated from the sphenoid sinus by an egg-shell thickness of bone or else was partly pneumatized by the sinus (see Fig. 3), and as a result of this observation we were forced to conclude that at least some cases of retrobulbar neuritis may be of sphenoidal origin.

Mental Symptoms: The presence of mental symptoms was a constant and characteristic feature of sphenoiditis which had progressed to the chronic state. They included forgetfulness, memory defect, inability to concentrate, depression and irritability.

Vertigo: This was almost universally present and varied from mild to severe. It was usually described as a sense of light-headedness or giddiness and was aggravated by the same factors that exaggerated the headache.

Laryngeal and Chest Symptoms: Symptoms referable to the lower respiratory tract were present as the result of the chronic postnasal drainage and allergic factors and were reflected in hoarseness, aphonia, tickling sensation in the throat, productive cough, retrosternal fullness and chest pain. Bronchial asthma was present in a few cases and one or two patients exhibited an early bronchiectasis. It has been suggested that chronic cough in sphenoiditis in the absence of chest findings may be due to Vidian nerve irritation.

General Symptoms: These were usually of marked severity and included nervousness, weakness, indigestion, nausea, with or without vomiting, poor appetite, fever, tachycardia, and muscular aches and pains. Fever of obscure origin may be due to a suppurative sphenoiditis with relatively few changes in the nose and throat to indicate its presence, as in one of our own cases. We are convinced that the sphenoid sinus is frequently overlooked as a focus of infection.

Signs: The local signs in the ear, nose and throat indicating the sphenoid as the focus of infection may be relatively abundant or else be conspicuous by their absence. Repeated examinations may be necessary to establish the diagnosis.

Nasal Signs: Signs within the nasal cavity which we noted were hypertrophy or hyperplasia of the posterior tip of the middle turbinate, and pus or a congested state in the region of the olfactory fissure. Frequently pus appeared in the olfactory fissure only after thorough shrinkage or after the use of suction. Cacosmia was characteristic. With the nasopharyngoscope we observed pus in the olfactory fissure pass downward over the posterior tips of the middle and inferior turbinates and finally gravitate to the floor of the nose. In such instances there was usually associated varying degrees of edema of the posterior tip of the inferior turbinate and congestion of the posterior fourth of the lateral nasal wall. While this usually means infection in the anterior group of sinuses, it may on occasion indicate sphenoid supuration. We followed this course of drainage several times following the installation of an opaque oil into the sphenoid for diagnostic purposes.

Pharyngeal Signs: Certain signs within the pharynx pointed to a diseased sphenoid. Those signs present in the naso-

pharynx were best observed with the nasopharyngoscope and the postnasal mirror. Here we saw pus or a congested state in the region of the sphenoidal ostium. While the presence of pus actually proceeding from the ostium of the sphenoid is undeniable proof of sphenoidal infection, we rarely made this observation. Discharge on the posterior border of the vomer and a hyperplastic state of the plica septi were strong presumptive evidence of sphenoid pathology. Sluder³¹ contended that the degree of hyperplasia of the plica septi indicated the extent of thickening of the sphenoid mucosa. We were not able to confirm this observation. Not infrequently residual lymphoid tissue in the vault of the nasopharynx revealed an irritated state as the result of the constant postnasal drainage. Pus or an area of congestion in the sphenothmoidal recess was a frequent occurrence, and we were amazed at the frequent finding of pus on the torus tubarius or actually within the pharyngeal ostium of the Eustachian tube.

The oropharynx frequently mirrored the presence of trouble above. Chronic pharyngitis was common and was of the simple chronic, chronic follicular, and rarely of the atrophic type. Hypertrophy of the lateral band of lymphoid tissue was a common finding. Casselberry³² at a relatively early period made some astute clinical observations on the types of pus present in the "attenuated type" of sphenoiditis and the effect which they produced on the pharyngeal mucosa. Sluder³³ in a combined clinical and experimental study pointed out that discharge originating in one sinus or group of sinuses might, as the result of certain anatomic configurations and the trowel-like action of the soft palate, be deposited at some place in the nasopharynx foreign to the point of origin and thus incriminate a healthy sinus.

Laryngeal and Chest Signs: Laryngeal signs were limited to those of chronic laryngitis, which at times was of the hyperplastic type. Chest signs were those of chronic bronchitis and occasionally those of bronchiectasis. Marked pulmonary fibrosis was seen in a few advanced cases.

Aural Signs: Aural signs were restricted to the presence of pus in the pharyngeal ostium of the Eustachian tube and to thickening and retraction of the tympanic membranes. Chronic suppurative otitis media and mastoiditis were present in several patients. In one patient we were able to induce

temporary cessation of aural discharge on several different occasions by lavaging the sphenoid.

Scalp: Generalized tenderness or soreness of the scalp on palpation was not an infrequent finding. Myalgic nodes were observed in two cases only, although many patients complained of definite localized tender areas in the scalp and neck occurring during the headache.

Color Acuity and Visual Fields: Disturbances in color acuity as stressed by Brown³⁴ and others were seen occasionally. Out of 64 patients on whom visual fields were taken, nine, or 14.6 per cent, showed varying degrees of contraction. This was seen most commonly in the hyperplastic type. In three cases of retrobulbar neuritis the contraction was marked.

Differential Diagnosis: Lermoyez once said, "It is not sphenoiditis that is rare, but its diagnosis that is uncommon." On a subject of such breadth we can hardly do more than refer to the excellent articles of Wagner,^{35,36} Fox,³⁷ Ridpath³⁸ and others which are limited to this phase of the subject.

There are, however, certain phases that we would like to emphasize. Sphenoiditis may be easily confused with brain tumor, as occurred in one of our cases. Many of our patients were labelled as neurotics and made the rounds of clinics with a chronic suppuration of the sphenoid apparently going unrecognized. We missed the diagnosis, too! Luetics, particularly those who had received incomplete antiluetic therapy, frequently presented symptoms almost indistinguishable from those of sphenoiditis. Migraine, trigeminal neuralgia, and even epilepsy may be readily confused. Two of our patients in whom a previous diagnosis of epilepsy had been made received complete relief from their "epileptic attacks" following attention to their suppurative sphenoiditis.

Bacteriology: Bacteriologic studies of sphenoiditis have been generally neglected. This state of affairs perhaps developed because of the relative inaccessibility of the sphenoidal ostium and because of the difficulty in securing a relatively sterile field for lavage such as may be obtained for work on the antrum.

Cavanaugh³⁹ as early as 1920 stressed the importance of sphenoid cultures. He made cultures from the lavages of 50

patients, and of this number, 34 showed staphylococci, six micrococcus catarrhalis, three staphylococcus and diphtheroid bacillus, and six cultures were negative.

Grove and Farrior⁴⁰ reported on the bacteriologic studies of 200 operative cases of hyperplastic nature in allergic individuals. The staphylococcus was the most frequent organism present in the sinus washings and membranes. The hemolytic streptococcus was found more frequently in the antral membranes (25 per cent) than in the antral washings (11.7 per cent) and more frequently in the antral membranes than in the sphenoidal and ethmoidal membranes (8.5 per cent). The pneumococcus and streptococcus viridans were found oftener in the washings and in the ethmoidal and sphenoidal membranes than in the antral membranes.

Grove and Cook⁴¹ studied 80 cases of hyperplasia clinically, bacteriologically and pathologically, and developed the theory of bacterial allergy as the cause of hyperplastic sinusitis. Of 51 ethmoid, sphenoid and turbinal membranes, 16 yielded negative cultures, but this was thought to be due to technique. They found that the ethmoidal and sphenoidal cultures were frequently different from those obtained from antral membranes and that the two antra sometimes gave different results.

Kistner⁴² studied the nonsuppurating hyperplastic membranes of more than 400 sinuses and found the streptococcus to be present in 95 per cent of cases. In addition, there were found in this order of frequency the staphylococcus, micrococcus catarrhalis, pneumococcus, Friedlander's bacillus, colon bacillus, diphtheroids and streptothrix. He also stated that a pure culture of one organism was seldom found in chronic sinusitis and that tissues removed from the antra and sphenoids yielded the same types of bacteria.

Pickworth⁴³ stated that the chances of finding organisms from saline washings of the sphenoid sinuses were 3:1, and that of the organisms found, 50 per cent would be staphylococcus, 40 per cent the streptococcus, 30 per cent diphtheroids and other organisms in proportion. His cultural and microscopic studies of chronically diseased sphenoid bone are a revelation. He emphasized the fact that the streptococcus growing in chronically diseased bone does not retain the geo-

metric regularity characteristic of the young forms growing under more favorable circumstances.

Rentschler and Scheifley⁴⁴ reviewed the literature on fungus infections of the sinuses, and Adams⁴⁵ reported a case of *aspergillus fumigatus* infection of the antrum, ethmoid and sphenoid. Kramer and Som⁴⁶ reported the first case of primary actinomycotic infection of the sphenoid diagnosed in the living patient.

In our series staphylococci were found in 64 per cent, streptococci in 26 per cent, pneumococci in 20 per cent, diphtheroids in 19 per cent, micrococcus catarrhalis in 9 per cent, *B. proteus* in 6 per cent, and Friedlander and Pfeiffer's bacillus in 2 per cent of cases. *Staphylococcus aureus* was found more frequently than *staphylococcus albus*. The differentiation of the streptococci was not complete enough to include in the study. Sterile cultures were obtained in 2 per cent of cases. Pure cultures of a single organism were rare. Organisms found growing most commonly on anaerobic media were the staphylococcus, the pneumococcus and *B. proteus*. It sometimes happened that there was a growth on the anaerobic culture when the aerobic culture failed to show growth.

In 27 cases cultures were made on Sabouraud's medium to determine the presence of fungi. *Aspergillus* was found in seven cases, penicillium in three cases, and three cases were reported as being positive for fungus but no classification was made. These results are difficult to interpret. The presence of a fungus in the pus from an infected sphenoid cannot be construed as a definite infection by this organism, but the results are suggestive and will bear further investigation.

Cytology: Tillotson⁴⁷ studied the aspirated secretions from 25 sphenoid sinuses and concluded that the normal sinus contains neither mononuclear nor polymorphonuclear leucocytes. In chronic infections he found a preponderance of mononuclear leucocytes and in acute infections a preponderance of polymorphonuclear cells.

Sewall⁴⁸ studied 98 sphenoid lavages from 65 patients. Of this number, 88 to 90 per cent showed flakes of pus, 2 per cent frank pus, and in 8 per cent the returns were clear. Polymorphonuclear cells or polymorphonuclear and mononuclear cells found in 13 per cent of cases were interpreted as indicat-

ing an acute or subacute inflammatory reaction, while the lymphocytes found in 34 per cent of cases pointed to an infection of chronic character. He stressed the absence of eosinophiles.

We were not able to place a great deal of interpretative value on our cytologic studies of sphenoid lavages. Clear returns of heavy mucus and returns with flakes of pus yielded very few cells in the centrifuged specimen. There was a striking absence of eosinophiles. We routinely employed Hansel's⁴⁹ stains in studying smears from the nose and sinuses for the presence of eosinophiles. We believe these stains to be the best available for demonstrating eosinophiles in secretions, yet we rarely found these cells in the pus from a sphenoid lavage. We consider this to be a characteristic feature of the cytology of sphenoiditis. The presence of histiocytes and lymphocytes in the pus was a common finding, and we interpreted it as evidence of chronicity.

Roentgenography: We are planning to report in more detail on this phase of the subject at a subsequent time. It suffices to say that after the sphenoids were injected with an opaque medium, we routinely employed four views in our study, including the 107° angle view of Granger, the mentovertex view of Hirtz, and the lateral view of Scheier, and the oblique view of Rhese.

Classification: Out of the total group of 75 patients, 26 (34.6 per cent) presented varying degrees of hyperplasia of the sphenoidal mucosa (see Fig. 11). The condition was bilateral in 22 (84.6 per cent) and unilateral in four (5.4 per cent) cases. Of the total group of 26 patients presenting hyperplasia, 19 (73 per cent) were females. Allergy was a factor in six (23 per cent) cases but studies were not completed on 20 (77 per cent) of this group. In two patients the Wassermann and Kahn blood tests were positive.

In a previous paper, one of us (LeJeune) classified hyperplastic ethmosphenoiditis into three major groups.⁵⁰ In this study we observed examples of each of these groups, but we also had a number of cases which definitely did not fall into any of these categories. Polyp formation was uncommon. We saw polypoid degeneration in the sphenoid at operation in only one case. The clinical diagnosis of hyperplasia was

substantiated in 11 patients by pathologic study of sections of the anterior wall and floor removed at operation.

Of the total number of 75 patients, 11 (14.6 per cent) exhibited hypertrophy of the sphenoid mucosa, the condition being bilateral in eight (72.7 per cent) cases. Allergy was a factor in seven (63 per cent) of the 11 cases. The rôle of allergy in the remaining four cases was not definitely determined.

The remaining group of 38 patients (50 per cent) fell into the chronic suppurative class. In one of these the serology was positive. On 18 patients (50 per cent) in this group of 38, allergic studies were completed. Out of this group of 18

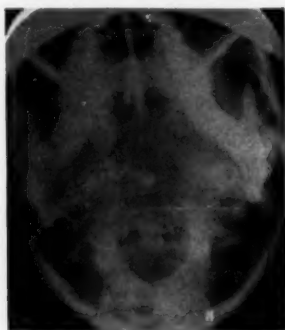


Fig. 11. Hirtz position showing extensive hyperplasia of the sphenoid. Serology positive.

patients, allergy was a factor in 13 (72 per cent) cases, and in 11 (61 per cent) it was of the bacterial type. In five (28 per cent) cases no allergic factor was present.

Treatment: Eleven patients in the hyperplastic group and two patients in the chronic suppurative class were subject to bilateral sphenoidectomy either alone or combined with an exenteration of the ethmoids and antra. Two patients in the suppurative class received an exenteration of the antrum and ethmoids, but no sphenoid surgery was done. The time which had elapsed since operation is not sufficient to afford a proper evaluation of operative therapy. In general there was some degree of clinical improvement almost universally. Whether

the results will be temporary or permanent remains to be seen. We experienced the usual difficulty in preventing contraction of the opening made into the sphenoid.

Those patients on whom operative procedure was advised but refused and others received conservative treatment by means of the Dowling tampon method, Proetz displacement method, and the direct method of lavage. We employed weak solutions of ephedrine sulfate in normal saline solution in the displacement method with benefit.

Except in selected cases the direct method of sphenoid lavage cannot be recommended as a routine procedure in the treatment of suppurative sphenoiditis. In those cases in which it is feasible we endorse the plan of direct lavage of the sphenoid followed by the displacement method of Proetz with the periodic instillation of an opaque oil as a method in the conservative treatment of chronic suppurative ethmoiditis. We are thoroughly convinced that an opaque oil introduced into the sphenoid sinus exerts a mild therapeutic effect of at least temporary duration. As a diagnostic procedure the direct method of lavage and injection of opaque medium into the sphenoid cannot be excelled.

REPORT OF CASES.

Case 1: R. C. V., white male, age 38 years, presented himself with the chief complaint of intermittent attacks of severe pain in the left side of the face and head of two years' duration. The pain began in the left first premolar tooth and radiated to the cheek, bridge of the nose, eye, forehead and temporoparietal region on the left side. It was sharp and lancinating in character, appeared at irregular intervals, and usually lasted for 15 to 20 minutes. At times the pain was mild and at other times so severe as to simulate *tic douloureux*, during which time the patient was prostrated. There was no trigger zone. After the severe attacks there was a feeling of soreness for about an hour in the areas in which the pain had previously been felt. During some attacks there was redness, lacrimation and blurred vision of the left eye. Two or three attacks daily were common. The pain was often aggravated by a head cold. We observed the patient in an attack which was precipitated by lavaging the sphenoid.

The past medical history was not important except for the fact that the patient had been treated for sinusitis over a period of about 10 years and had been subjected to a previous tonsillectomy and submucous resection.

Examination, Course and Treatment: The patient came under our observation May 7, 1940. Examination of the nose and throat revealed a chronic rhinitis of the hyperplastic type, chronic pharyngitis and chronic laryngitis. There was a bilateral chronic catarrhal otitis media. The heart, chest and abdomen were clinically normal. The ophthalmological examination showed the presence of a slightly contracted left pupil and marked contraction of the visual fields.

The laboratory studies were normal. Transillumination revealed a marked opacity of the right antrum. A Roentgenogram previously made was reported as negative. The sphenoidal sinuses were lavaged and pus obtained from both sinuses. Laboratory study of the washings showed the presence of streptococci and diphtheroids on culture and the presence of polymorphonuclear and epithelial cells on cytologic study.

On May 17, 1940, the sphenoid sinuses were injected with iodochlorol. The Roentgen report was negative except for marked pneumatization of the pterygoid process on the left side (see Fig. 1). Within a week the patient was free of symptoms and remained so until September, 1940, when he again returned to the clinic with the history of recurrence of symptoms following a head cold of 10 days' duration. The sphenoids were lavaged and pus found bilaterally. On Sept. 12, 1940, the sinuses were again injected with iodochlorol. The Roentgenologist reported the presence of localized areas of hypertrophy in both sinuses, most marked on the left in the region of the base of the pterygoid process. The injection was again followed by relief of symptoms, and on Oct. 17, 1940, it was again repeated. The X-ray at this time showed a normal sinus except for the pneumatized pterygoid process. Because of the difficulty in catheterizing the sinuses and to facilitate treatment, operation was advised but refused.

Comment: We believe this was a case of neuralgia of sphenoidal origin. The relationship of attacks to head colds and the marked pneumatization of the pterygoid process are characteristic features. Such a syndrome might be mistaken for an atypical case of trigeminal neuralgia. Owing to the marked anatomic variation in the sinus, therapy of this type of case, whether medical or surgical, is usually a difficult problem.

Case 2: E. C., white female, age 23 years, was first seen in April, 1941, with the chief complaint of attacks of headache, vertigo, nausea and vomiting syncope, weakness and nervousness of one year's duration. The pain began in the frontal region and radiated to the temporoparietal region and occiput. It was bilateral but worse on the right side and usually of a severe aching character with sharp lancinating pains occasionally. The pain lasted two or three hours at a time, occurred at irregular intervals, and was only partially relieved by sedatives. During unusually severe attacks there was marked vertigo, occasionally climaxed by syncope of 20 to 30 minutes' duration. The attacks had become more severe and more frequent in the past three months. A diagnosis of epilepsy had been made by the family physician. The past medical history was not important.

Examination: Examination of the nose revealed a septal deflection and edema of the posterior tip of the right inferior turbinate. There was some congestion of the posterior fourth of the lateral nasal wall on the right, and adenoid tissue was seen in the vault of the nasopharynx. Chronic pharyngitis was present and the tonsils were absent. Posterior rhinoscopy showed the presence of edema and hyperemia at the base of the uvula with a slight amount of mucus present. The larynx was normal. The drum membranes were slightly thickened. There was marked opacity of the anterior ethmoids on transillumination. The laboratory studies, including serology, were negative. The heart, chest and abdomen were normal clinically. The ocular fundi were normal and there was no disturbance of color acuity or contraction of the visual fields.

An X-ray made on April 8, 1941, revealed an opacity of the right ethmoids and the right sphenoid. The sphenoids were lavaged and the returns found to be clear. On April 14, 1941, the sphenoids were injected with brominol and X-rays made. The Roentgenologist reported bilateral hyperplasia (see Fig. 4).

Operation and Course: On April 23, 1941, the patient was subjected to a submucous resection of the septum and a bilateral sphenoidectomy under local anesthesia. The postoperative course was uneventful. There was complete relief of all symptoms following the operation, and the patient regained weight which had been lost during the three months previous to receiving treatment. The pathologist reported marked hyperplasia of the sphenoidal mucosa.

Comment: The symptomatology presented by this patient led to a previous diagnosis of epilepsy. Such dramatic results following sphenoidectomy occur but are rare.

Case 3: B. O., white female, age 28 years, came to the clinic with the chief complaint of "sick headaches" and postnasal dripping of 10 years' duration. The pain began in the frontal region and radiated to the temporoparietal region, occiput and down the side of the neck to the shoulder on the left side. It was usually sharp in character and occurred at irregular intervals but frequently appeared during the night. It lasted from three or four hours to one or two days with periodic remissions and exacerbations. The pain was made worse by exercise, sudden movement of the head, stooping and rarely by the menses.

During prolonged attacks there were associated vertigo, nausea with frequent vomiting, weakness, nervousness and indigestion. The patient at this time was unable to concentrate, forgot easily, became depressed and irritable, and "wanted to be left alone." At times during the attacks there were flashes of light before the eyes and blurred vision.

The patient had been treated for sinusitis since June, 1940. A submucous resection of the septum had been advised but refused.

Examination: We first saw the patient March 3, 1941. Examination at this time revealed a marked septal deflection, hyperplastic rhinitis, and chronic pharyngitis. After shrinking the nose, a slight amount of mucopurulent material appeared in the olfactory fissures. A small amount of mucopus was seen on the posterior border of the vomer. The tonsils were absent. The tympanic membranes revealed slight retraction. The paranasal sinuses were very clear on transillumination. X-rays made on July 2, 1940, and on Feb. 17, 1941, were reported to be negative by the Roentgenologist. The ocular fundi were normal. The visual fields were markedly contracted bilaterally, but there was no disturbance of color acuity. The general physical examination was negative and laboratory studies were normal.

Operation and Course: On March 6, 1941, a submucous resection of the septum was done under local anesthesia. On April 17, 1941, the sphenoids were lavaged and a considerable quantity of mucus with scattered flakes of pus was obtained from the right side. The returns from the left were clear. Laboratory study showed the presence of polymorphonuclear cells and a few red blood cells on the smear and the presence of staphylococcus aureus on both aerobic and anaerobic culture. A culture made on Sabouraud's medium showed the presence of penicillium.

On April 25, 1941, the sphenoids were injected with Ipiodine diagnostic. The Roentgenograms revealed the presence of bilateral hyperplasia with a marked degree of pneumatization of the left optic canal (see Fig. 3).

On May 7, 1941, the patient was subjected to a bilateral ethmoidectomy under local anesthesia. Tissue removed from the ethmoidal

regions was reported by the pathologist to be hyperplastic with polypoid degeneration and chronic inflammation. Sections from the anterior wall and floor of the sphenoid showed the presence of hyperplasia and chronic inflammation.

Comment: This patient's symptoms are somewhat suggestive of those of migraine but apparently originated from diseased sphenoidal sinuses. Plain X-rays failed to reveal a hyperplastic mucosa later shown by use of an opaque oil.

Summary and Conclusions: During the past year, 1940-1941, we lavaged and injected the sphenoid sinus with opaque medium by the direct method in a total of 97 patients. Out of this group the studies on 75 were sufficiently complete to be included in this report. These patients were all selected because of symptoms and signs which immediately focused the attention on the sphenoids as the source of trouble. During the course of this investigation we reviewed the English literature on the sphenoid sinus for the past 40 years. About 350 articles on this subject were found listed in the Index Medicus, and approximately 325 of these were available to us in the library of the Tulane University School of Medicine.

In our experience the direct method of lavaging and injecting the sphenoid for diagnostic purposes was highly satisfactory. We gave the average measurements from the columella to the posterior wall of the sinus and stated the average oil content of the sinus as we found them to be present. Fineman's method for measuring the intranasal distance to the sphenoid was not sufficiently accurate in our hands to warrant adoption, although our experience with the method was limited. Etiologic factors were outlined, and the rôle of anatomic variations of the sphenoid sinus in the production of sphenoiditis was stressed, together with the influence of frequent head colds, sore throats and influenza. Symptoms due to sphenoiditis were both local and general. Headache was classified into four major groups. In our opinion, which is based on the study of the frequent and peculiar anatomic variations of the sphenoid sinus, we believe that some cases of retrobulbar neuritis may be of sphenoidal origin, and we believe that sphenopalatine neuralgia when of sphenoidal origin may be due to involvement of either the Vidian or maxillary nerve.

Signs due to sphenoiditis may be reflected in both the upper and lower respiratory tree. Many cases of chronic catarrhal

otitis media and some cases of chronic suppurative otitis media are unquestionably due to a diseased sphenoid. Edema of the posterior tip of the inferior turbinate with a congested state in the posterior fourth of the lateral nasal wall may indicate sphenoid pathology in some cases. Disturbances in color acuity and contraction of the visual fields were seen in the hyperplastic type of sphenoiditis. The differential diagnosis included such conditions as neurosis, brain tumor, migraine, tic douloureux, syphilis and epilepsy.

The staphylococcus, streptococcus, pneumococcus and diphtheroids were the most common bacterial invaders of the sphenoid, and the presence of a fungus was indicated in a number of cases. The most characteristic feature of the cytologic study was the absence of eosinophiles. The presence of histiocytes and lymphocytes was interpreted as evidence of chronicity.

Out of the total group of 75 patients, 26 (34.6 per cent) were classified as hyperplastic. The condition was more prevalent in the female (73 per cent), and involved both sinuses in 84.6 per cent of cases. Out of the total group of 75 patients, 11 (14.6 per cent) exhibited hypertrophy of the sphenoid mucosa. The remaining 38 patients (50 per cent) were of the chronic suppurative type. Allergy was a factor in both groups of cases.

We proposed a plan of therapy in the treatment of selected cases of suppurative sphenoiditis consisting of direct lavage of the sinus followed by the displacement method of Proetz with periodic instillations of an opaque oil. We are convinced of the temporary mild therapeutic value of the halogenated oils.

Sphenoiditis in children is probably far more common than generally recognized. In several children in whom its presence was proven the symptoms were mainly those of frontal headaches, head colds, malaise, poor appetite and fever. One child, age 12 years, who had been of the allergic diathesis since childhood, revealed a hyperplasia of the sphenoid mucosa.

We take full cognizance of the fact that we contributed little that was new on the subject of the sphenoid. In presenting some of our most significant findings we hoped to do little

more than keep alive interest in the problems concerned in the diagnosis of the inflammatory state of this, the most fascinating and intriguing of the paranasal sinuses.

BIBLIOGRAPHY.

1. TREMBLE, G. E.: Irrigation of the Sphenoid Sinus. *Arch. Otolaryngol.*, 32:952, Nov., 1940.
2. LOBELL, A.: Puncture — Irrigation of the Sphenoidal Sinuses with a New Instrument. *THE LARYNGOSCOPE*, 36:270, April, 1926.
3. SPIELBERG, W.: A New Sphenoidal Trocar and Cannula for Diagnostic Puncture and Treatment of the Sphenoid Sinus. *Technique. THE LARYNGOSCOPE*, 38:122, Feb., 1928.
4. FRASER, R. H.: Iodized Oil (Ipiodol) in Otolaryngologic Diagnosis. Opaque Injection Study of 35 Maxillary Sinuses. *Jour. Mich. State Med. Soc.*, 25:270, March, 1926.
5. PROETZ, A.: Displacement Irrigation of Nasal Sinuses. *Arch. Otolaryngol.*, 4:1, July, 1926.
6. MAC CREADY, P. B.: Iodized Oil as an Aid in the Diagnosis of Chronic Sinusitis and of Maxillary Cysts. *Boston Med. and Surg. Jour.*, 195:464, Sept. 2, 1926.
7. GOODYEAR, H. M.: Iodized Oil in the Diagnosis of Nasal Sinus Conditions. *Arch. Otolaryngol.*, 4:223, Sept., 1926.
8. LORELL, A.: The Injection of Iodized Oil into the Sinuses, with Special Reference to the Technique in the Sphenoidal Sinuses. *THE LARYNGOSCOPE*, 37:473, July, 1927.
9. GROVE, R. C.: The Use of Colloidal Thorium Dioxide in Roentgenography of the Paranasal Sinuses. *THE LARYNGOSCOPE*, 50:1165, Dec., 1940.
10. PROETZ, A. W.: The Minute Anatomy of the Sphenoid Ostium. *Trans. Am. Laryngol. Assn.*, 55:125, May, 1933.
11. JESSOP, W. H.: Two Cases of Proptosis Associated with Diseases of the Sphenoid. *Trans. Ophthal. Soc., U. Kingdom*, 24:198, Oct.-July, 1904.
12. KERNAN, J. D.: A Case of Tuberculosis of the Sphenoid Sinuses. *THE LARYNGOSCOPE*, 29:276, May, 1919.
13. KURZAK: *Ztschr. f. Tuberk.*, Leipzig, July, 1921, 34, No. 6. Abstracted in *Jour. A. M. A.*, 77:1059, Sept. 24, 1921.
14. DRUSS, J. G.: Intracranial Complications Associated with Disease of the Sphenoid Bone. Report of Two Cases: (1) Meningitis Secondary to Infection of the Craniopharyngeal Canal (?) and (2) Abscess of the Frontal Lobe. *Arch. Otolaryngol.*, 10:39, July, 1929.
15. DAVISON, C., and KAHR, S.: Carcinoma of the Sphenoid Sinuses with Invasion of the Cranial Cavity. *Arch. Otolaryngol.*, 14:16, July, 1931.
16. LYMAN, H. W.: Simulated Mastoiditis Relieved by Sphenoidectomy. *THE LARYNGOSCOPE*, 34:948, Dec., 1924.
17. FINOT, P. H.: Report of Three Cases of Simulated Mastoiditis Relieved by Sphenoidectomy. *U. S. Vet. Bur. Med. Bull.*, 3:472, Jan.-Dec., 1927.
18. SLUDER, G.: Etiology, Diagnosis, Prognosis and Treatment of Sphenopalatine Ganglion Neuralgia. *Jour. A. M. A.*, 61:1201, Sept. 27, 1913.

19. VAIL, H. H.: Vidian Neuralgia from Disease of the Sphenoid Sinus. *Arch. Surg.*, 18:1247, April, 1929.
20. VAIL, H. H.: Vidian Neuralgia. *Ann. Otol., Rhinol. and Laryngol.*, 41:837, Sept., 1932.
21. VAIL, H. H.: Diseases of the Sphenoid Sinus as the Cause of Reflex Pain in the Head. *Trans. Am. Laryngol., Rhinol. and Otol. Soc.*, 40:294, April, 1934.
22. SAUER, W. E.: Headache of Nasal Origin. *Ohio State Med. Jour.*, 32:212, March, 1936.
23. REICHERT, F. L.: Tympanic Plexus Neuralgia: True Tic Douloureux of the Ear or So-Called Geniculate Ganglion Neuralgia; Cure Effected by Intracranial Section of the Glossopharyngeal Nerve. *Jour. A. M. A.*, 100:1744, June 3, 1933.
24. OAKS, L. W., and MERRILL, H. G.: The Sphenoidal Sinus Syndrome. *Ann. Otol., Rhinol. and Laryngol.*, 39:753, Sept., 1930.
25. BLISS, M. A.: The Importance of the Paranasal Sinuses in the Explanation of Pain in the Face, Head and Shoulders. *Trans. Am. Neurol. Assn.*, May, 1915, p. 235.
26. GARBER, H.: Sinusitis and Neuralgia. *Arch. Otolaryngol.*, 18:339, Sept., 1933.
27. PROETZ, A. W.: The Displacement Method of Sinus Diagnosis and Treatment. St. Louis, Annals Pub. Co., 1939.
28. SLUDER, G.: The Relations of the Sphenoid Sinus to the Eustachian Tube and Their Possible Clinical Importance. *Trans. Am. Laryngol. Assn.*, 1916, p. 281.
29. FISHER, J. A.: The Present Status of Sinus Infection as an Etiologic Factor in Retrobulbar Neuritis. *Ann. Otol., Rhinol. and Laryngol.*, 44:274, March, 1935.
30. VAIL, H. H.: Retrobulbar Neuritis Originating in the Nasal Sinuses. *Arch. Otolaryngol.*, 13:846, June, 1931.
31. SLUDER, G.: Nasal Neurology, Headaches and Eye Disorders. St. Louis, C. V. Mosby Co., 1927.
32. CASSELBERRY, W. E.: Attenuated Types of Suppurative Sphenoiditis in Relation to So-Called Postnasal Catarrh, to Headache with Mental Daze, and to Asthma. *Jour. Ophthal. and Otolaryngol.*, 7:210, July, 1913.
33. SLUDER, G.: The Correlated Action of the Pharynx and Soft Palate and Its Effects Upon Postnasal Diagnosis. *Trans. Am. Laryngol. Assn.*, 1914, p. 143.
34. BROWN, M. E.: Color Acuity: Its Importance in the Early Diagnosis of the Diseases of the Conducting Paths and Diseases of the Neuroepithelium. *New Orleans Med. and Surg. Jour.*, 78:671, April, 1925-1926.
35. WAGNER, W. A.: Similarity of Signs and Symptoms of Sphenoiditis to Intracranial Lesions and Their Differential Diagnosis. *Southern Med. Jour.*, 22:478, May, 1929.
36. WAGNER, W. A.: The Diagnosis and Conservative Treatment of Sphenoidal Suppuration. *Ann. Otol., Rhinol. and Laryngol.*, 40:1099, Dec., 1931.
37. FOX, C. C.: Sinus Headache: Differentiated from Headaches of Other Origin. *Arch. Otolaryngol.*, 20:813, Dec., 1934.

38. RIDPATH, R. F.: Diagnosis and Differential Diagnosis of Accessory Sinus Disease. *Med. Clin., N. Am.*, 22:1591, Nov., 1938.
39. CAVANAUGH, J. A.: Observation on Sphenoid Sinuses III. *Med. Jour.*, 37:520, Dec., 1920.
40. GROVE, R. C., and FARRIOR, J. B.: Chronic Hyperplastic Sinusitis in Allergic Patients. *Jour. Allergy*, 11:271, March, 1940.
41. GROVE, R. C., and COOK, R. A.: Etiology and Nature of Chronic Hyperplastic Sinusitis. *Arch. Otolaryngol.*, 18:622, Nov., 1933.
42. KISTNER, F. B.: Histopathology and Bacteriology of Sinusitis. *Arch. Otolaryngol.*, 13:225, Feb., 1931.
43. PICKWORTH, F. A.: Organisms in Chronic Bone Infections of the Sphenoid. *Jour. Laryngol. and Otol.*, 50:206, June 8, 1935.
44. RENTSCHLER, H. D., and SCHIEFLEY, C. H.: Fungous Infections of the Sinus. *Arch. Otolaryngol.*, 29:146, Jan., 1939.
45. ADAMS, N. FLOYD, JR.: Infection Involving the Ethmoid, Maxillary and Sphenoid Sinuses and the Orbit Due to *Aspergillus Fumigatus*. *Arch. Surg.*, 26:999, June, 1933.
46. KRAMER, R., and SOM, M. L.: Actinomycosis of the Sphenoid with Actinomycotic Meningitis and Brain Abscess. *Ann. Otol., Rhinol. and Laryngol.*, 44:973, Dec., 1935.
47. TILLOTSON, R. S.: Sphenoiditis: Value of Cytologic Studies in Diagnosis. *Arch. Otolaryngol.*, 10:262, Sept., 1929.
48. SEWALL, E. C.: Cytologic Study of the Sphenoid Sinus. *Ann. Otol., Rhinol. and Laryngol.*, 42:391, June, 1933.
49. HANSEL, F. K.: Allergy of the Upper and Lower Respiratory Tracts in Children. *Ann. Otol., Rhinol. and Laryngol.*, 49:1, Sept., 1940.
50. LEJEUNE, F. E.: Recent Observations on Hyperplastic Sphenoiditis. *Southern Med. Jour.*, 21:847, Oct., 1928.

THE EARLY DEVELOPMENT OF THE TEACHING OF OTOLOGY IN EUROPE AND AMERICA.*

(PRESIDENTIAL ADDRESS.)

DR. ERNEST M. SEYDELL, Wichita.

Three fourths of a century ago, on July 22, 1868, 17 members of the American Ophthalmological Society decided to form a national organization, at the sessions of which they might discuss otological problems. Thus was created the American Otological Society, whose seventy-fifth anniversary we celebrate this year. Seventy-five years, when compared with the aeons that have passed since this world was created, are like grains of sand on the seashore of time, but when we compare the age of this organization with the existence of otology as a recognized specialty, we may in truth consider it an ancient and venerable institution.

In this connection it is interesting to remember that only a little over a hundred years ago otology did not have a respectable standing and the men who practiced our specialty were mostly charlatans. This is well illustrated by the following incident: a number of physicians were attempting to organize an eye and ear hospital in London. It was customary to have some outstanding physician act as honorary president and thus lend his prestige to the institution. Accordingly, John Abernathy, who was then at the height of his fame, was asked to serve in this capacity. His reply was as follows: "I can see no good that can arise from this to the public; it may be of use to surgeons, but I candidly tell you I consider it quackery and I will never lend my hand to sanction it. Every surgeon should be acquainted with the diseases of the organs of sight and hearing: to detach them from regular surgery would be not less injurious to the science than oppressive to the public." In his day and time this statement would have been echoed there, here and everywhere. Even 32 years ago when I informed some of my friends that I intended to become an otolaryngologist, I

*President's Address read at the Seventy-fifth Annual Meeting of the American Otological Society, Inc., Atlantic City, May 28, 1942.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, June 2, 1942.

received this rather rude but not unwarranted retort: "So you are going to become another spray bottle doctor." In those days, except possibly in metropolitan areas, the otolaryngologist was largely a spray bottle doctor.

Centennial celebrations and the like are made for pause and reflection. It seemed apropos, therefore, to devote the annual presidential address to some historical phase of otology. I have chosen to speak to you on The Early Development of the Teaching of Otology in Europe and America.

In a general way there was but little instruction given on the diseases of the ear, either in Europe or the United States, until the middle of the nineteenth century. Largely as a result of the rapid strides that were being made in otology at that time, it became possible for a few physicians scattered throughout Europe and America to persuade the faculties of their respective universities of the necessity for otological instruction. At first this instruction consisted of lectures in the classroom on the anatomy and diseases of the ear, or it was given in dispensaries in the form of clinical lectures. In either instance, attendance was not obligatory. As a result of the development of otology, more and more patients presented themselves for treatment of diseases of the ear until it became necessary to establish permanent clinics, in which both undergraduate and graduate instruction was given. The unprecedented progress of our specialty was in a great measure due to these clinics.

Knowing that the organization of the American Otological Society preceded that of all other similar organizations, I was prompted to investigate and compare the beginnings of otological instruction in the universities of Europe and those of the United States of America, and also to compare the dates and locations of the establishment of the first otological clinics. Because of the fundamental differences in the methods of instruction given in various countries, for example, England and France, it was impossible to outline a precise comparison between all of them; however, the methods of teaching in Austria, Germany and the United States have enough similarity to make this possible.

The first record which I could find of instruction being given in otology in Europe was at the Allgemeinen Kranken-

haus in Vienna in 1861. Here it never became an obligatory course. By 1878, the subject was being taught in 14 of Germany's universities, and at this time they could also boast of nine departments of otology. In 1911, it became obligatory to teach otology in all of the German universities.

The first hospital in Europe for the treatment of diseases of the ear was the St. Mark's Ophthalmic and Aural Hospital, established in Dublin as a private institution by William Wilde in 1844. In England the first ear clinic was opened in St. Mary's Hospital, London, in 1851. In Vienna an otological clinic was established at the Allgemeinen Krankenhaus in 1873. By 1878, Germany had instituted ear clinics in 12 out of 20 of her universities. These ear clinics became obligatory for all of her universities in 1911.

Now, let us turn to our own country for contrast. In preface to the following remarks let me state that it has been impossible for me to obtain accurate and complete information relative to the development of the teaching of otology in our universities, due to the fact that as far as I could find, no one connected with these schools has been interested in compiling the necessary data. I hope that the otologists of these institutions will at some time in the future see that this is done, for we can truly be proud of the development of otology in America. My data is based on such records as were obtainable (usually old catalogues) from the 10 oldest medical schools in the United States of America and from various other sources of information in reference to our oldest clinics. The names of these medical schools in the order in which they were established are: The University of Pennsylvania School of Medicine, Columbia University College of Physicians and Surgeons, Harvard Medical School, Dartmouth Medical School, the University of Maryland School of Medicine, Yale University School of Medicine, the University of Vermont College of Medicine, the Medical College of the State of South Carolina, George Washington University School of Medicine and Jefferson Medical College of Philadelphia.

Instruction in otology in our medical schools was first given at Dartmouth in 1824, at Jefferson three years later and at Columbia in 1841. Maryland began in 1867, Harvard

two years later, Yale in 1876 and South Carolina introduced otological instruction in 1881.

It was still more difficult to obtain accurate information as to when otology first became an obligatory course in our institutions. In most instances I assumed that the data should coincide with that of the establishment of the department of otology or otolaryngology. Columbia seems to have been the first to inaugurate an obligatory course of otology. This was in 1870. Pennsylvania followed in 1874, Vermont in 1876, Yale in 1878 and South Carolina in 1881. Harvard joined the ranks in 1888, as did George Washington four years later. Jefferson and Dartmouth began in 1894 and 1904, respectively. Only five of our 10 oldest medical schools have at any time had a department of otology. Vermont was the first, having instituted the department in 1876. Harvard followed in 1888, Jefferson in 1894, Dartmouth in 1904 and Pennsylvania established one in 1912. In this respect Canada ranks highly, for Laval University had a department of otology in 1862, McGill in 1883 and Toronto in 1887.

The first clinic in America for the treatment of diseases of the ear was established by Dr. Elisha North in New London, Conn., in 1817. The New York Eye Infirmary was instituted in 1820. In 1864, its official title was changed to the New York Eye and Ear Infirmary. In 1821, the Institute for Diseases of the Eye and Ear was established in Philadelphia. The Pennsylvania Infirmary at Philadelphia was organized at about the same time. Dr. George B. Wood, the uncle of Dr. George B. Wood, of Philadelphia, was on the staff of this hospital. The Baltimore Dispensary, a similar institution, was organized in 1823. The Massachusetts Charitable Eye and Ear Infirmary came into existence in 1824, and finally the Wills Eye Hospital of Philadelphia, the last of our earlier hospitals, was established in 1834.

A resumé and comparison of these statistics shows that European otological instruction had its beginning at Vienna in 1861 and in Germany some time between 1861 and 1878. In the United States, six of our medical schools were giving some form of instruction between the years of 1824 and 1881. The first otological clinic in England was established in 1844, in Austria in 1873 and in Germany between the years of 1873 and 1878. In the United States, the first of our six old clinics came into existence in 1817, 27 years before the earliest

European clinic, and the last one was established in 1834. The first department of otology in Europe was established in Vienna in 1861 and in Germany between 1861 and 1878. In five of America's 10 oldest medical schools, a department of otology was established between the years 1869 and 1894. Thus, the data which I have presented shows that America's present eminence in the field of otology can in a large measure be attributed to the early development of instruction in this field of medicine.

It is an odd coincidence that on the fiftieth anniversary of the birth of this organization, the United States entered the first World War, and on its seventy-fifth anniversary we again find ourselves involved in a world conflict. This time it is the most momentous struggle that has occurred since the dawn of civilization. We cannot contemplate defeat; but peace requires of each and every one of us an effort of the mind and imagination such as has not been called for since our country was founded. For, obviously, to merely preserve the status quo will solve none of our problems. In the service of our country and humanity we are called upon to live up to age-old ideals and with them make a new world. If this peace is to be more lasting, we must all give of ourselves to our country in peace as well as in war.

Many of our younger members are already in the military services of our country. Others are occupied with another very important task, that of teaching our future medical officers; while to those who, for various reasons, are unable to be of active service in these fields is left the task of caring for the health of our defense workers and civilian population. Despite the increased and onerous burden which the war has put upon us, we must not put aside scientific medicine. Valuable contributions can be made by those in the armed services as well as by those who remain at home. In addition, the latter must in these times be more than guardians of the health of our people; we must also be guardians of our American aims and principles if we wish to keep faith with those who are risking all in active service.

In conclusion, I express to you my deep and sincere appreciation for the honor you have conferred upon me in selecting me to serve as your President this past year.

1023 First National Bank Building.

**ACUTE FRONTAL SINUSITIS: THE TREPHINE
OPERATION FOR DRAINAGE IN
SELECTED CASES.***

DR. LAWRENCE R. BOIES, Minneapolis.

The majority of cases of acute frontal sinusitis resolve under conservative treatment. Such treatment usually consists of rest in bed, general medical supportive care, shrinkage of the nasal mucosa, particularly in the middle meatus of the involved side, and the local application of cold or heat. Infraction of the middle turbinate and actual irrigation of the involved sinus, if a cannula can be introduced without undue trauma through the nasofrontal duct, can also be considered to be conservative treatment. In fact, removal of the anterior tip of the middle turbinate, as practiced by some rhinologists, is relatively conservative, inasmuch as it is easily accomplished and does not necessarily impair future nasal function.

The advent of the sulfonamide compounds has furthered the cause of conservation; however, a growing experience with the use of these drugs indicates that their action is not as effective in inflammatory bone lesions as with soft tissue, and when an empyema or abscess forms, it is still important to drain pus when feasible.

When, under the conservative measures mentioned, there is definite and continued improvement in the fever and headache of an acute frontal sinusitis, the rhinologist usually has no cause for concern. When, however, fever persists and the headache is not relieved, it is probable that drainage is inadequate. If, in addition, there develops an actual edema of the upper eyelid of the involved side, a grave danger signal is present to denote an actual spread of the inflammation without the walls of the involved sinus.

The complications of frontal sinusitis which are the most greatly feared are osteomyelitis and abscess within the cra-

*Presented as a candidate's thesis to the American Laryngological, Rhinological and Otological Society, Inc.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, April 20, 1942.

nium, either extradural or within the brain substance. Less serious, but dangerous, is the invasion of the orbit by the inflammatory process.

The pathology of this spread is now well understood. When drainage from the infected frontal sinus is not free, the pus under pressure causes a diminution of blood supply, which predisposes to necrosis of the mucous membrane and thrombosis of the perforating veins. There follows a thrombosis of the diploic veins with a spread of the organism. Pus and granulations fill the diploë, osteal necrosis occurs and the emissary veins may carry the infection through either or both tables of the skull. The contributions of Woodward,¹ Mosher and Judd,² and Furstenberg³ on the pathogenesis and treatment of osteomyelitis of the frontal bone have emphasized the importance of this understanding.

When some form of surgical therapy seems necessary in an acute frontal sinusitis, one of three procedures may be considered:

1. Intranasal enlargement of the nasofrontal duct.
2. External trephine.
3. External operation on the sinus with removal of grossly diseased bone and lining membrane combined with enlargement of the nasofrontal communication.

The first method is a relatively blind procedure. Because of this fact, it often fails to provide the necessary drainage safely and adequately.

The second method would seem to be soundly conceived and based on an old and correct surgical principle; however, it has not been a satisfactory method in the experience of some rhinologists. The probable reasons for this form the background for this discussion and will be considered later.

The third method has been widely used, but the danger of inciting an osteomyelitis is now well appreciated and this fact has caused a more conservative attitude toward radical surgery in the presence of acute inflammations. When a spreading osteomyelitis is actually present, the radical management of the sinus and the complication is now generally accepted among rhinologists to be the procedure of choice.

THE EXTERNAL TREPHINE.

The external trephine can fail to accomplish its purpose only if it does not provide adequate drainage or in that it is not a safe procedure.

Adequate drainage should be provided if it opens a frontal sinus before the pressure has been in effect long enough to cause the necrosis and thrombosis which is part of the pathogenesis of complications of acute frontal sinusitis. The time element, therefore, seems to be important in the adequacy of this type of treatment. This will be illustrated later in case reports.

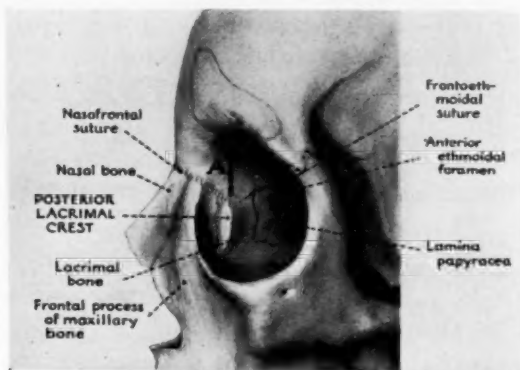


Fig. 1. A sketch indicating the position and relationships of a line extended upward from the posterior lacrimal crest. Mellinger has pointed out that cancellous bone may be present in the anterior wall of a frontal sinus if pneumatization has not been complete, and that surgical opening through this type of bone is disposed toward osseous involvement by the inflammation. When external drainage is indicated, the opening should be made posterior to a line extended upward from the posterior lacrimal crest. (A—in the figure.)

The external trephine cannot be considered safe if it is conducive to the development of an osteomyelitis. Mellinger⁴ has pointed out that cancellous bone may be present in the anterior wall of a frontal sinus if pneumatization has not been complete, and that surgical opening through this type of bone is disposed toward osseous involvement by the inflammation. "Therefore, when external drainage is indicated, the approach should be made through the sinus floor, where these dangers are greatly minimized. However, there is some danger here if the opening is made anterior to a line extended upward from the posterior lacrimal crest (see Fig. 1), as this

area often contains diploic structure which may extend across the suture into the frontal process of the maxilla, or even into the base of the nasal bones, thus making this the most vulnerable region, as the diploë will be found to extend backward between the two frontal sinuses, being continuous with those of the posterior sinus wall and the crista galli."

One finds in the literature some lack of agreement over the effectiveness and safety of the simple trephine. Crowe⁵ recommends, in the handling of an acute frontal sinusitis needing surgical intervention that this simple form of drainage be the first step. He states that:

"The mucous membrane of the sinus and the nasofrontal duct must not be curetted or disturbed in any way at the first operation. A small rubber tube is left in the external opening and the sinus irrigated with normal salt solution at frequent intervals. If the edema in the nasofrontal duct subsides sufficiently to allow the irrigating fluid to flow out through the nose, the progress as regards a complete cure without operation is good."

Williams,⁶ of the Mayo Clinic, recommends in an acute frontal sinusitis "as evidenced by severe frontal pain, a generalized febrile reaction and edema of the brow, a small opening through the floor of the frontal sinus for drainage and aeration should immediately be made."

An opposite view is taken by Skillern,⁷ who states:

"We think that in an acute frontal disease, conservation should be the rule until the temperature and other acute symptoms subside, providing internasal drainage can be established without incision. If the intersinus pressure is so great that surgical drainage is essential, we do not believe that a small trephine opening for drainage is good surgery, as we have too many osteomyelitis extensions follow this procedure."

When operation seems necessary, Skillern apparently would radically remove the front wall, clean out the sinus and enlarge the nasofrontal opening. Four cases form the background for his paper. In Case 1, 25 years of age, palliative treatment was carried out for 13 days in the presence of swelling of the upper left eyelid, and headache. Then a trephine, 2 cm. in diameter, was made through the inner angle

of the left eyebrow and there was a copious purulent discharge. The patient subsequently had a left sphenoethmoidectomy, later a left Caldwell-Luc, and eventually died of a brain abscess. Dr. Skillern remarked in a final note to the case history: "This is the fourth case of osteomyelitis with intracranial complications following the trephining of the frontal bone for drainage of the frontal sinus. I now believe this to be a dangerous procedure."

Case 2 had a "right exophthalmia." The time relationships in the development of the symptoms were not given. A radical operation resulted in recovery. At operation, a fistula was found through the outer third of the sinus floor and "several spots of softened bone were encountered" apparently in the anterior wall of the sinus. In Case 3, the patient apparently had a greatly swollen upper eyelid in which there was an eventual rupture and fistula. The family doctor enlarged the fistula. The first surgery on the sinus was done about three months after the onset of symptoms. The patient was eventually cured of an osteomyelitis and brain abscess. In Case 4, the frontal sinusitis with swelling of the lid was treated palliatively for three weeks before operation was deemed necessary. The patient recovered from an osteomyelitis and what apparently was a superficial brain abscess.

Two points are of special interest in these cases from the standpoint of my thesis. The first is that the one case trephined had the opening made through the inner angle of the left eyebrow. This apparently was not through the floor of the sinus but through the outer wall. The second point is that all four cases had marked swelling of the upper lid but that there was a long time interval between the onset of this sign and adequate surgical drainage. In the three cases in which time relationships are mentioned, the shortest time interval was apparently 13 days.

I have, within the past year and one-half, treated four cases of acute frontal sinusitis complicated by progressive edema of the upper lid so as to close the eye. All were promptly relieved by the simple trephine operation. A brief summary of each case, listing only the pertinent facts, follows:

Case 1: M. E. S., age 21 years, female student, was hospitalized on March 11, 1939, because of severe frontal headache, chiefly on the right side, and fever. The temperature on admission was 100.4° F., the leucocyte

count was 16,000, and the hemoglobin 88 per cent. This girl had had the headache for the preceding four days and had had a severe head cold for the preceding four weeks. Examination of her nose revealed pus draining from the middle meatus into each nasal fossa. X-rays taken three days before admission had shown "a bilateral maxillary, ethmoid and probable frontal sinusitis." X-rays taken the day after admission were reported to show "marked bilateral maxillary, ethmoid and sphenoid sinusitis, with the frontals fairly clear."

On March 12, 1939 (the second hospital day), the temperature reached 101° F., and a swelling of the left upper eyelid developed. The headache now was localized to the left frontal area, which was tender to external pressure. Sulfanilamide therapy was started.

On March 13, 1939, the eye had become swollen shut. Cultures of the nasal pus taken on the preceding day were reported to show beta hemolytic streptococci. A simple trephine of the left frontal sinus was performed (Dr. J. A. Hilger), allowing the escape of pus under pressure. A rubber tube was anchored in the opening for drainage.

On March 14, 1939, the headache had practically ceased. Sulfanilamide therapy was continued. The blood level on March 17, 1939, was 9.8 mgm. per 100 cc.

The tube was removed on March 22, 1939. Healing was prompt and uneventful, with resolution in all the sinuses.

Case 2: J. A., boy, age 13 years, was hospitalized by his pediatrician, Dr. Arild Hansen, on Feb. 2, 1940, because of fever, headache and swelling of the left upper lid. His temperature on admission was 102° F., the leucocyte count was 13,900, and his hemoglobin 84 per cent. He had an acute rhinitis and sinusitis. The organism was determined by culture to be a nonhemolytic streptococcus. Sulfanilamide therapy was started. Blood level determination of this drug was reported as 8.9 mgm. per 100 c.c. of blood on the second day and 16.7 mgm. on the third day of its administration. X-rays were reported to show a bilateral maxillary and ethmoid sinusitis.

On Feb. 5, 1940 (the third hospital day), the temperature had reached 102.8° F., and the hemoglobin had fallen to 73 per cent, and the leucocyte count to 7,600. A small blood transfusion (250 cc.) was given.

During the three-day period the swelling of the left upper lid had progressed to a complete closure, had become a deep red in color and was very tense. A slight chemosis of the bulbar conjunctiva was evident and the eye seemed to be somewhat displaced downward and medially. Dr. E. W. Hansen saw the eye in consultation and agreed that there was probably pus in the orbit.

On Feb. 6, 1940, under intratracheal gas anesthesia, a small incision was made through the left upper lid at the lateral superior rim and carried down through the periosteum. A blunt hemostat was inserted extraperiosteally to a depth of 2.5 cm., but no abscess was found. Another incision was then made as for an external ethmoid approach, and the periosteum was elevated over the roof of the orbit medially and along the lamina papyracea, exposing the anterior ethmoid artery. No pus was found. A small elevator was then inserted through this second opening toward the first one and an abscess containing 3 or 4 cc. of pus was encountered under the roof of the orbit just under the rim. A small trephine, a centimetre in diameter, was then made through the floor of the frontal sinus at its medial aspect, revealing a sinus containing pus and swollen membrane. A cigarette drain was placed through and through the incisions. Both antra were irrigated by puncture through the inferior meatus on each side and a moderate amount of pus was washed out.

Recovery was prompt. The drain was out six days later and the patient was discharged from the hospital on the seventh postoperative day. Healing was uneventful.

Case 3: M. S., girl, age 12 years, who had been subject to frequent upper respiratory infections, developed fever and right frontal headache on May 3, 1940. Three days later (May 6, 1940), her temperature had risen to 104.2° F., the leucocyte count was reported to be 13,600, and the hemoglobin 79 per cent. There was some swelling of the right upper lid.

I first saw this case on May 7, 1940, the fourth day of her illness. The right eye was swollen shut. There was a moderate edema of the forehead above the orbit. Pus was noted draining from the right middle meatus. The temperature on that day had been 99.2° F. at 8 A.M., and reached 104° F. at noon. There was no history of chills. X-ray studies were reported as revealing "well developed sinuses with moderate involvement of the right maxillary, ethmoid and frontal sinuses." The patient had been treated by an internist, Dr. Charles Hutchinson, with hot packs, nose drops and rest in bed. Sulfanilamide therapy was added.

On May 8, 1940, the swelling had increased so that the upper lid was tense. The edema of the forehead had not increased. Culture of the nasal pus made on the previous day had been reported as a nonhemolytic streptococcus.

A small incision, 1.5 cm. long, was made as for an external ethmoid operation. When the orbital periosteum was elevated, pus escaped from a small orbital abscess. No fistula was found. A small trephine opening, about 1 cm. in diameter, was made through the floor of the frontal sinus, allowing the escape of pus under pressure. A soft rubber tube was inserted for drainage. Convalescence was uneventful. The drain was removed on the seventh postoperative day. Healing was prompt (see Fig. 2).

Case 4: E. M., girl, age 15 years, was hospitalized on June 19, 1940, because of headache and a right eye that was swollen shut. The onset of the headache five days previously had followed a head cold. The swelling of the eye had been gradual; she had been under a rhinologist's care, who had diagnosed a sinusitis and treated her with nasal shrinkage, bed rest and cold compresses.

When I saw her first on the day of her hospital admission, there was a tense edema of the upper lid. The lids could be separated only with difficulty. There was a small amount of chemosis of the bulbar conjunctiva and there seemed to be a slight exophthalmos. Pus was evident in the right middle meatus. The temperature was 99.8° F., the leucocyte count 16,200, and the hemoglobin 74 per cent. X-rays of her sinuses revealed a right pansinusitis in which the frontal appeared to be only moderately involved.

Under gas anesthesia an incision was made as for an external ethmoid operation. A small subperiosteal abscess was encountered below the floor of the frontal sinus. No fistula was found. The frontal sinus was trephined through the floor, allowing the escape of pus under pressure. In doing this trephine, a large ethmoid cell adjacent to the sinus floor and containing pus, was opened. This cell was gently removed, making a roomy nasofrontal communication. A curved hemostat inserted up through the middle meatus was used to draw a cigarette drain gently through the trephine opening and down to exit at the nostril. An end was left protruding through the skin incision above.

Recovery was uneventful except for a rise in temperature on the third postoperative day. This was unaccompanied by any other significant signs. The culture from the sinus pus had been reported as a non-

hemolytic streptococcus and a staphylococcus. Sulfanilamide therapy was started when the temperature rose, was continued three days and then stopped. The drain was removed on the seventh postoperative day. A day later, the patient was discharged from the hospital. Healing was prompt and uneventful.

COMMENT.

It seems reasonable to believe that the relatively short time interval (as compared to the cases of Skillern) between the



Fig. 2. A healed trephine incision (Case 3). The incision through the soft tissue is about 1.5 cm. in length. It is placed about half way between a midpoint in the nasal bridge and the inner canthus of the eye. The lower end of the incision should not be below the level of the inner canthus. Elevation of the periosteum is started in the upper half of this exposure. Reference to Fig. 1 will show that this position is mostly above the suture lines and the lacrimal fossa, where elevation is more difficult.

onset of the edema of the lid and the surgical drainage may account for the satisfactory results in these cases. In the first case, but two days had elapsed; in the second case, four days; in the third case, five days; and in the fourth case, four days between the time at which the trephine was performed and the onset of the swelling.

Within the period in which these four cases were seen, I have cared for two cases of acute frontal sinusitis with a slight to moderate edema of the upper lid which under conservative care have resolved safely. In each of the four cases reported here, the edema was progressive.

In Cases 1 and 2, the X-rays of the frontal sinuses did not really confirm the clinical suspicion of a frontal sinusitis. One of the X-rays for Case 2 is shown in Fig. 3. I have previously been misled by the Roentgenologist's report of a negative frontal sinus, only to acquire eventually evidence that the sinus was apparently filled with pus at the time when first suspected. It has been pointed out by MacMillan that in the early acute stage of frontal sinus inflammation, there may be enough decalcification to allow greater light penetration on exposure to X-ray than would occur in the normal



Fig. 3.

Case 2(a). This view of the frontal sinus taken with the patient in the upright position is misleading, in that it does not reveal the fact that the left frontal sinus contains pus. MacMillan has pointed out that in the early stage of an acute frontal sinus inflammation, there may be enough decalcification to allow greater light penetration on exposure to X-ray than would occur in the normal sinus. Hence, the involved sinus may, by contrast, look as healthy as the uninvolved side.

Case 2(b). A similar view of the same sinus was taken over eight months later to satisfy our curiosity as to the X-ray appearance of this sinus as a result of the trephine operation. Note the normal appearance of the frontal sinus and the clear ethmoids below.

sinus. Hence, the involved sinus may, by contrast, look as healthy as the uninvolved side.

Differential diagnosis in the matter of the orbital symptoms has not been considered in detail in this discussion, inasmuch as the sinusitis was rather obvious in these particular cases. Rhinologists are agreed no doubt that inflammation within the orbit is mostly commonly caused by nasal sinus suppuration (72 per cent, according to Davis, Mygind, Howells and Capps⁸), and that in children the source is usually from the ethmoids and in adults from the frontals.

Our descriptive terminology is probably inaccurately used, in that we so frequently use the term "orbital cellulitis" to describe most any inflammatory process in the orbit short of the picture in a fulminating cavernous sinus thrombosis. Hubert,⁹ in a review of 112 cases of orbital infection due to nasal sinusitis, classifies these infections into five groups:

1. Inflammatory edema of the eyelids, with or without edema of the orbit.

2. Subperiosteal abscess, with *a.* edema of the lids and orbit; *b.* spreading of pus to the lids (erroneously called orbital abscesses).

3. Orbital abscess.

4. Orbital cellulitis — *a.* severe; *b.* mild.

5. Cavernous sinus thrombosis — *a.* septic; *b.* aseptic (?).

The first case which I have reported here would be in Group 1, and the other three in Group 2a.

SUMMARY.

Acute frontal sinusitis from which drainage seems inadequate under conservative care, as indicated by unrelieved headache or marked progressive edema of the adjacent upper eyelid, or both, is a potential cause of complicating osteomyelitis or abscess within the cranium.

Simple trephine drainage of the involved sinus, if it can be performed with relatively little risk of a spread through the inflamed bone, should be a logical procedure. This trephine should be entirely through the sinus floor. There is a need of securing this drainage early in the disease.

The use of the sulfonamides has furthered the cause of conservatism but their use alone has not been effective in curing an empyema or bone inflammation.

BIBLIOGRAPHY.

1. WOODWARD, F. D.: Osteomyelitis of the Skull: Report of Cases Occurring as a Result of Frontal Sinus Infection with *Staphylococcus Pyogenes Aureus*. *Jour. A. M. A.*, 95:927-929, Sept., 1930.
2. MOSHER, H. P., and JUDD, D. K.: An Analysis of Seven Cases of Osteomyelitis of the Frontal Bone Complicating Frontal Sinusitis. *THE LARYNGOSCOPE*, 43:152-212, 1933.

3. FURSTENBERG, A. C.: Osteomyelitis of the Skull: The Osteogenetic Processes in the Repair of Cranial Defects. *Ann. Otol., Rhinol. and Laryngol.*, 40:996, 1931.
4. MELLINGER, W. J.: The Venous Circulation as a Factor in Osteomyelitis of the Skull. *Ann. Otol., Rhinol. and Laryngol.*, 49:438-446, June, 1940.
5. CROWE, S. J., in Lewis' Practice of Surgery. W. F. Prior Co., Hagerstown, Md., 1930, 4:3:20.
6. WILLIAMS, HENRY L.: Acute Infections of the Upper Respiratory Tract. *Jour.-Lancet*, 60:95-98, March, 1940.
7. SKILLERN, S. R.: Osteomyelitis Invasion of the Frontal Bone Following Frontal Sinus Disease. *Ann. Otol., Rhinol. and Laryngol.*, 48:392-411, June, 1939.
8. DAVIS, E. D. D.; MYGIND, S. H.; HOWELLS, G. H., and CAPPS, F. C. W.: Orbital Cellulitis Due to Sinus Infection and Its Treatment. *Jour. of Laryngol. and Otol.*, 52:834-848, Dec., 1937.
9. HUBERT, LOUIS: Orbital Infections Due to Nasal Sinusitis. *N. Y. State Med. Jour.*, 37:1559-1564, Sept. 15, 1937.

Medical Arts Building.

THE ENDAURAL REPAIR OF POSTAURICULAR FISTULAS.

DR. LEIGHTON F. JOHNSON and DR. ADRIAN SOLO, Boston.

There appears to be an ever increasing number of otologists with convictions that for certain operations, at least on the temporal bone, the endaural approach is definitely the one of choice.

In previous writings, one of us (L. J.) has declared his conversion to this approach for radical and modified radical mastoid surgery and has used it in 20 cases for the fenestration operation of otosclerosis. The endaural approach as advanced and taught by Lempert simplifies and facilitates the operation of radical and modified radical mastoidectomies and enhances the end-result. As we have had no experience with any approach other than endaural in fenestration surgery and as we have never seen an otosclerosis case operated in any other manner, there is obviously no background for comparison.

During 16 years of otolaryngological practice it has been necessary a great many times to effect closures in persistent postauricular fistulas. Possibly because of an association with the Haynes Memorial, Contagious Department of the Massachusetts Memorial Hospitals, more of these cases have been seen than is the experience of certain of our colleagues who have not contagious hospital affiliations. Previous to the three cases here reported, a variety of technical procedures were carried out to correct the postauricular defects. While no case can be recalled which ultimately was not closed, some of the techniques employed were difficult to execute; and it was invariably felt after operating such cases that there must be some simpler and more satisfactory method of closing these fistulas.

Since Lempert has acquainted one of us (L. J.) with his operation for the endaural repair of these fistulas, three cases have presented themselves for closure. As his operative procedure proved so delightfully simple to perform in each of

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Sept. 18, 1941.



Fig. 1. Postauricular fistula.

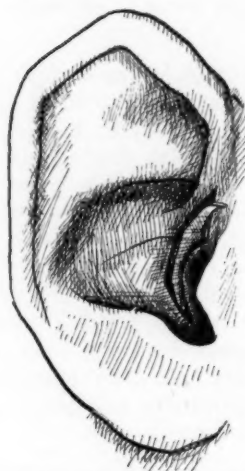


Fig. 2. Endaural incisions.

these cases, and as the results were so satisfactory, the operation appears to warrant a far greater degree of popularity than it is now accorded.

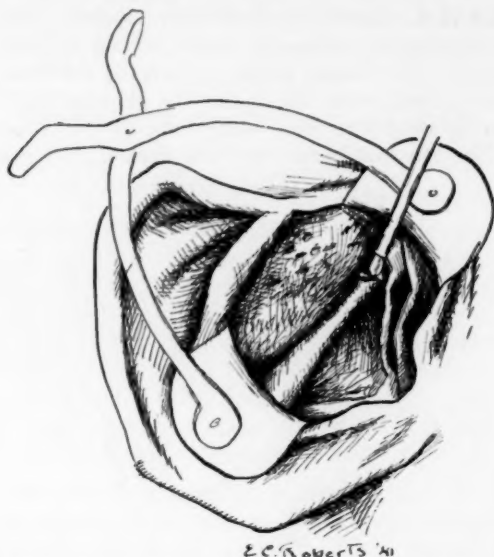


Fig. 3. Exposure of mastoid by endaural approach showing the fistulous tract. The fistulous tract is being elevated from its bed in the mastoid.



Fig. 4. Everted fistulous tract which is amputated flush with the old scar.

The remarkable degree of auricular mobilization which is achieved by the endaural incisions gives skin and tissue

"enough and to spare" to close these fistulas. The fistulous tract is separated endaurally from its bed in the mastoid, and everted. The excess tissue or everted fistulous tract is then excised flush with the line of the old scar and its edges are then sutured together with some of the subcutaneous tissue. The mastoid cavity is then packed with gauze end-



Fig. 5. Closure of postauricular defect.

aurally to overcome any depression in the postauricular region.

In one of our cases the fistulous tract was in contact with a widely exposed lateral sinus. It was separated from the sinus, however, with ease and with no tear or bleeding.

The postauricular defect was healed within four days in all three cases. The mastoid cavities filled in promptly with granulations, leaving no unsightly depression or any cavitation beneath the postauricular scar. The patients were discharged with dry middle ears and healed endaural incisions.

The results obtained in these three cases have led other members of our staff to try this technique, and thus far there have been no failures.

29 Bay State Road.

FRACTURES OF THE MALAR BONE.

REPORT OF CASES.

DR. J. H. CHILDREY, San Francisco.

A "black eye," one of the commonest results of trauma to the face, is not infrequently associated with fracture of the malar bone. The fracture may be hidden by the swelling and ecchymosis, which are generally marked; but the examining physician should always keep in mind the possibility of fracture. In none of the cases of malar fracture seen in the past year at this hospital had either the patient or the referring physician suspected the seriousness of the disability, all the patients having come in because of black eye.

The malar bone, or zygoma, small, flat and quadrangular, with four processes, forms not only the prominence of the cheek but also part of the lateral wall and floor of the orbit and a portion of the temporal fossa, and assists in joining the maxilla to the skull. It is relatively strong, but has weak supports, and is in such an exposed position that it is often dislocated by blows. The increased speed of automobiles and other transportation makes for increase in the frequency of injuries to this bone.

Injuries to the malar bone are seldom uncomplicated; accurate diagnosis is often difficult, and reduction of the fracture is in too many instances delayed until after the bone has become united in an improper position, with a resultant facial deformity which may lead to psychic disorders. The body of the bone itself is seldom fractured, but fractures usually involve some of the four processes along the suture lines where these articulate with four other bones. The processes are: the long, narrow temporal process, which articulates with the zygomatic process of the temporal bone; the frontosphenoidal process, which articulates with the zygomatic process of the frontal bone; the maxillary process, which articulates with the maxilla and the great wing of the sphenoid to form part of the floor and lateral wall of the

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, May 1, 1941.

orbit. The anterior margin of the orbital process is smooth and rounded and is part of the circumference of the orbit.

Just within the orbital margin of the frontosphenoidal process and 1 mm. below the zygomaticofrontal suture is a tubercle to which are attached: 1. the cheek ligament of the rectus lateralis; 2. the lateral end of the aponeurosis of the levator palpebrae superioris; 3. the suspensory ligament of the eye; and 4. the lateral extremities of the superior and inferior tarsi. The masseter muscle is attached to the posteroinferior, or zygomatic, border of the malar bone.

Simple uncomplicated fracture, or displacement of the malar bone, is uncommon. As a rule, neighboring bones, such as the anterior wall of the antrum, are involved; or the alveolar process may be broken, the palatal suture separated or the malar bone driven downward and impacted into the maxilla. The temporal process alone may be fractured. The most common displacement of the malar bone is downward and backward, producing a deformity characterized by flattening of the cheek and depression of the infraorbital border and zygomatic arch. Soon after the injury, so much tenderness and swelling of the soft tissues exist that the displacement is not apparent, and examination is poorly tolerated. It is several days later, after the swelling has subsided, that the deformity becomes manifest.

DIAGNOSIS.

It is unnecessary to wait for subsidence of the swelling before making a diagnosis, for with careful digital examination the orbital rim and zygoma may be outlined, searched for a break in continuity and compared with the opposite side. It may be possible to outline the margins of the malar bone, and one should palpate within the mouth and on the cheek for abnormal motility and crepitus. The dental arches and palate must be examined for separation of the palatal suture or fracture of the upper alveolar process.

Echymosis of the conjunctiva and mucous membrane of the cheek are common, and nosebleed on the affected side may occur. Nosebleed is suggestive of a fracture extending into the antrum, associated with a hematoma in this location. Anesthesia of the upper lip and side of the nose occurs when

the infraorbital nerve is bruised or lacerated, and tests for such involvement must be carried out. There may be malocclusion and a problem in dental prosthesis, due to fracture of the upper alveolus. Trismus is often present when the zygoma, to which the masseter muscle is attached, is injured. When the orbit is involved by the break, its floor may present a large defect, and palsy of the ocular muscles may occur; there may be slight enophthalmos on this side, or the globe may lie on a lower level than that of the opposite eye. Orbital abscess, with loss of vision, has been reported as a complication of fractures of the malar bone.

Roentgenograms occasionally reported as negative must not be relied on unless positive. The exposure must be made with the purpose of demonstrating a displacement of the zygomatic arches, and this is done by directing the rays from the chin toward the vertex. An anteroposterior view may show a depression of the infraorbital border, as well as cloudiness of the antrum, which may be caused by the presence of a hematoma.

TREATMENT.

It is best to reduce the fracture within a week, before fibrous union occurs, in order to facilitate ease of reduction, hasten healing, obviate spread of infection and prevent permanent deformity. Mistakes in diagnosis are too often the cause of delay. Only if the patient is in shock or has a serious skull fracture or other severe injury, or if there is a suppurating infection of the face is it justifiable to wait before replacing the fractured bone.

If the skin is lacerated, and providing the bone is not comminuted, it may be possible, by introducing a sharp, strong metal hook into the laceration, to engage the displaced bone and draw it back into position. In order to prevent formation of scars, any lacerations of the skin should be cleansed of blood and foreign material. Then the edges should be carefully approximated and sutured with fine interrupted silk sutures on atraumatic needles. Sulfanilamide powder may be placed in any lacerations before suturing, for its bacteriostatic effect on bacteria. The circulation of the face is so good that unless the wound is extensively undermined, drainage to prevent infection is seldom necessary. Bleeding

must be carefully controlled, however, because a hematoma is liable to become infected. If there is a likelihood of hematoma formation, a pressure bandage should be applied for at least two days, providing this does not displace the fractured bone. If infection is present, the use of continuous hot compresses is necessary, with other measures.

Several methods of correction of uncomminuted malar fractures have been employed besides the use of a hook through the skin of the cheek. One may engage the fractured bone by a blunt instrument introduced from above through the temporal fossa, or from below by way of the upper third molar region through the infratemporal fossa, or by way of the nose, the instrument pushing the bone into position from its antral surface.

In our experience, these fractures are usually comminuted with involvement of the antral or orbital walls, and in these cases the transantral approach by way of the canine fossa is preferred. The fragments are manipulated into position by the finger in the antrum; an antrum window is made, and the antrum is packed with iodoform gauze to aid in keeping the bone in position. The gauze is subsequently removed by way of the window. It is seldom necessary to use other measures to hold the bone in position. Small fragments of bone may be removed, but where possible it is best to preserve even these to prevent deformity. Pressure which might subsequently displace the bone is to be avoided for a few weeks. When the alveolus is fractured, interdental wiring is used to obtain occlusion and repair.

In cases in which treatment has been greatly delayed and there is a permanent deformity of the cheek, the bone may be refractured and set, or the depression may be built up by the use of implants of costal cartilage. Enophthalmos may be corrected by the insertion of costal cartilage along the floor of the orbit.

REPORT OF CASES.

Case 1: A man, age 34 years, was knocked down and kicked in the face. Examination a few days later showed vision in the left eye of 10/60—, marked swelling and ecchymosis of both left eyelids and of the left cheek, moderate swelling of the skin over the nasal bridge, an abrasion of the left upper eyelid, a laceration in the left lower lid and a punctured wound of the left cheek (see Fig. 1, A and B). The left cheek was flattened; there was pain on opening the mouth, an ecchymo-

sis in the buccal region on the left, and anesthesia on the upper lip and the left side of the nose.

A Roentgenogram (see Fig. 2) showed grayness of the left ethmoids, antrum and orbit, marked depression of the orbital floor and depression and break in continuity of the infraorbital margin. The frontosphenoidal process was fractured and the lateral orbital margin displaced downward and mesially.

The following day the fracture was exposed by an incision beneath the left upper lip. It was extensively comminuted and involved the anterior, posterior and lateral walls of the antrum. The floor of the orbit was shattered and the globe depressed and palpable through the antrum. The heavy pyriform process was shattered, and the infraorbital margin was in three pieces. All four processes of the malar bone had been fractured, involving the lateral nasal wall formed by the thick bone of the nasal process of the maxilla. Several smaller fragments of



Fig. 1. (A) and (B) "black eye" and depression of the malar prominence; (C) appearance after reduction of the malar fracture.



Fig. 2. Roentgenogram showing fracture of the malar bone involving the orbit and antrum. There is an extensive hematoma in the ethmoid and maxillary sinuses on the left.

bone were removed; the other, with the malar bone, were replaced. The hematoma was removed from the antrum; a window was made into the antrum, and the fragments were secured in place with iodoform packing. Sulfanilamide and prontosil were given postoperatively as prophylactics.

Convalescence was uneventful. Because of the quantity of bone lost from the orbital floor, it will be necessary later to implant cartilage there to correct the depression of the left eyeball. Diplopia was present on looking down and to the left, but improved within two weeks after operation. The anesthesia of the lip caused by laceration of the infraorbital nerve will improve, but more slowly. Vision in the left eye three weeks postoperatively was 10/10—2 (see Fig. 1C).

Case 2: A woman, age 37 years, came for examination a month after an accident which caused swelling and anesthesia of the right side of her face, neither of which had improved. There was depression of the right malar eminence, right zygomatic arch and infraorbital margin, anesthesia of the right cheek and swelling of the soft tissues over the right canine fossa. A small quantity of mucopus was present on the floor of the right side of the nose. A Roentgenogram (see Fig. 3) showed a fracture through the right frontosphenoidal process, the orbital process, the zygomaticotemporal process and the maxillary process, as well as through the lateral wall of the right antrum.

Because the fracture had become firmly united in a poor position, a Caldwell-Luc operation was performed on the fractured maxilla, and the malar bone was mobilized and replaced in position. The mucosa of the antrum was found to be polypoid, and the posterior wall of the antrum had also been fractured. The antrum was tightly packed with iodoform gauze, and sulfanilamide was given postoperatively for five days.

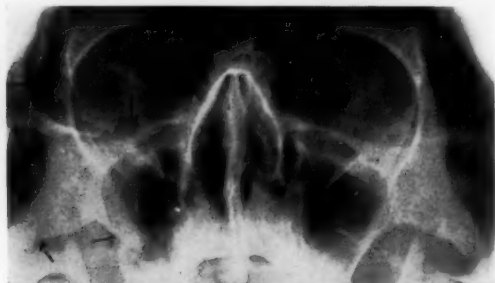


Fig. 3. Roentgenogram showing fracture of the four processes of the malar bone.

Convalescence was uneventful. The anesthesia became less and the swelling of the soft tissues gradually subsided.

Case 3: A girl, age 21 years, was in an automobile accident. Her left eye and cheek were blackened and swollen. Examination showed swelling and trismus, with an open bite due to malocclusion. There was a laceration in the skin of the left temple and left lower eyelid. Digital examination clearly showed a break in continuity of the infraorbital margin and zygomatic arch and depression of the left malar region. The molar teeth and alveolus on the left were movable. Roentgenograms were made elsewhere and were reported negative; therefore, the patient and another physician disagreed as to the diagnosis of fracture of the malar bone.

This patient has not been seen by us since the examination.

Comment: Marked depression of the cheek may result unless such fractures are corrected.

Case 4: A man, age 20 years, missed a fly ball, which struck him on the cheek. He was unconscious for more than half an hour. He received emergency treatment for the black eye and came to the hospital the next day for further treatment.

The upper and lower eyelids on the right were markedly swollen and ecchymosed. There was a laceration 1 cm. long over the right zygoma.

Vision in the right eye was 10/10. The right side of the nose felt stuffy, and the cheek and incisor teeth on the right were anesthetic. Digital examination revealed a depression of the right malar bone, so a presumptive diagnosis of fracture was made and Roentgenograms were advised. An anteroposterior view (see Fig. 4) was reported as showing "fluid in the right antrum, grayness of the right ethmoids, no fracture demonstrated." There was a history of sinus infection, but in spite of the negative Roentgen report, operation was advised. A Caldwell-Luc operation was done, and the fracture was found to involve the fronto-



Fig. 4. Roentgenogram showing fracture of the malar bone involving the antrum. There is a hematoma in the antrum.

sphenoidal process, the maxillary process and lateral wall of the antrum, and the orbital process. There was a large hematoma in the antrum. A fragment of bone was removed from the anterior antral wall, the displaced malar bone replaced and the antrum packed with iodoform gauze.

Convalescence was uneventful. Four months later, the anesthesia of the right cheek and incisors had almost completely disappeared.

GENERAL COMMENT.

In four cases of proved fracture of the malar bone, Roentgenograms were reported negative for fracture. The surgeon should always examine the Roentgen films in order to correlate Roentgen and clinical findings. The use of Roentgenograms has today become so widespread that patient and physician are likely to depend too much on them and consider them, particularly in cases of fracture, as the alpha and omega of diagnosis.

Green's Eye Hospital.

A CASE OF SEVERE EPISTAXIS PRESENTING PROBLEMS AS TO ETIOLOGY, DETERMINATION OF ORIGIN AND METHODS OF CONTROL.*

DR. ARTHUR J. WAGERS, Philadelphia.

Many of us have experienced one or more attacks of epistaxis at some period of our existence. These attacks have varied as to causation and the ease with which bleeding has been controlled. Usually these cases do not present great difficulty. In the following case, however, unusual features developed which may prove of interest. Attempt will be made to narrate events and observations made as nearly as possible in the order of occurrence.

The patient was a male, Italian by birth, age 39 years. According to his statement, the first bleeding occurred during the night of March 28, 1940. He was awakened by "blood spurting from the nose." After half an hour bleeding ceased without medical attention. There was no more bleeding until the early morning hours of March 30. Bleeding not having stopped after more than an hour, the patient was taken to Jefferson Hospital, where he was given emergency treatment and after two hours of good work on the part of the accident ward staff, bleeding was arrested.

In the meantime the patient's personal physician, Dr. C. D. Smith, had been called, and at the latter's direction patient was admitted to a private room. About midday of March 31, bleeding having recommenced, Dr. Smith asked me to see his patient and do for him whatever I believed to be indicated.

I found the patient in bed and bleeding freely from the right naris. On the left side was a postnasal and anterior pack, placed there at time of arrival at the accident ward. As there appeared to be no bleeding from the left naris, I hastily concluded that the packing had been placed on the wrong side of the nose.

Attempt was made to locate the bleeding points, but with blood flowing so freely no real headway could be made. The

*Read before the Philadelphia Laryngological Society, Dec. 3, 1940.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 10, 1941.

only definite conclusion reached at this time was that the blood was not coming from Kiesselbach's area. It appeared to be coming from farther back and was flowing backward into the pharynx, as well as forward through the nasal passage. Not being able to check the flow of blood sufficiently to make satisfactory examination, I placed a postnasal pack on the right side and also packed the anterior chamber. The gauze packing was saturated with 20 per cent alumnol solution. This same solution in 10 per cent strength had usually given excellent results in intranasal bleeding from any cause. Bleeding ceased after this packing of the right side and the packing on the left side was removed. Nothing of interest could be seen in the left naris at this time.

What of this patient's past health history and his present physical condition?

He was of large stature, six feet tall and weighing 245 pounds when he came to the hospital. He stated that he had always been generally well. He had pneumonia at the age of 6 months. One mild epistaxis in 1926, which had been quickly and easily controlled. No bleeding since, until the present attack. No history of hemophilia in his family. He told of having a sore throat in 1929, at which time "something was cut"—probably a peritonsillar abscess. During the past 10 years he has been subject to attacks of hay fever. For this condition he has had treatment. He has always been a "heavy eater" and consumed alcoholics in moderation. In the spring of the year it had long been his custom to take potassium iodide. This was not done by direction of a physician and the dose varied from an initial daily dose of 1 gr. up to a maximum dose of 25 gr. when it was discontinued. This was done as a sort of body housecleaning measure to rid the system of the winter's accumulation of waste products. He had frequently observed bluish spots appearing on the forehead and face soon after drinking an alcoholic beverage and at such times he would become somewhat "short of breath."

From this history we find two items which were given consideration as possible causative factors. First, the patient was evidently allergic to something which was determined later. As against this condition being the immediate cause of bleeding, we note that this occurred in the spring while the

patient was entirely free from hay fever attack. We can certainly eliminate sneezing as the exciting cause and, besides, one could not say that violent epistaxis is the usual accompaniment of hay fever even during the height of the attack. High blood pressure is undoubtedly responsible for epistaxis in some elderly persons, but this patient was only 39 years of age, and at the time of this attack his blood pressure was not high and the bleeding first appeared while the patient was sleeping in bed. It was not, therefore, brought on by violent exercise.

The second item which suggested possibilities was the matter of potassium iodide. I have not been able to find that this drug causes weakening of blood vessels. I think we can eliminate this as an etiologic factor, but the fact remained that there has been definite rupture of a vessel wall somewhere in this patient's nose.

At the outset, Dr. Smith had asked Dr. Tocantins, of the division of hematology, to make careful blood studies. These were begun soon after the patient's admission and were continued daily throughout his stay in the hospital.

As for blood pressure, it was never high enough at any time to suggest its being immediately responsible for the bleeding. The average systolic pressure was never far from 120.

On March 30, the third day after onset of bleeding, hemoglobin was 70 per cent; white cells, 6,000; red cells, 3,600,000; C. I., 0.96; bleeding time, 30 seconds; and coagulation time, one minute.

It should be said at this point that the patient when first seen by me was already receiving vitamin K in doses of 1,000 units, also fibrogen 3 cc. with bile salts. Fibrogen was discontinued after three days, while vitamin K was continued several days longer. Unfortunately, we do not know the bleeding or coagulation time before onset of bleeding or immediately after, but if these time elements had been delayed, they must have been brought up to normal within a short time. Certainly there was no question as to the blood clotting outside the blood vessel. As a matter of fact, the clotting added to the difficulty of examining the nasal chambers.

The patient was kept under sedation, although he was free from pain. The temperature on the day of admission varied between 98° and 101°. During the next two days it ranged from normal to 101°, gradually reaching a fluctuating level of 98° to 99°.

My seeming success in arresting the bleeding by packing the right naris and postnasal space proved to be of short duration, for several hours later I was called to see the patient on account of renewed bleeding. I found blood coming from the packed side, the open side of the nose and from the mouth. Examining the parts as well as could be done with blood flowing from every quarter, I revised my previous conclusion that bleeding originated on the right side only. It now appeared to be coming from both sides and the postnasal area as well.

I now placed a postnasal pack on both right and left sides and closely packed the anterior chambers. Again, bleeding was arrested. It was now April 2, the sixth day of recurrent hemorrhage. At this time it was thought that blood transfusion might become necessary and relatives were called in for blood typing. There was more bleeding on April 3, but after controlling this attack, bleeding apparently ceased. There was no bleeding on April 4, 5, 6, 7 or 8 — five days of watchful waiting on our part. The last packing had been removed on the sixth. Although we believed that, after seven days of severe, intermittent bleeding, we had the situation finally and definitely under control, we kept the patient quiet in bed.

During this quiet interval I was able to make fairly satisfactory examination of the nares and the nasopharynx. A malignant growth was suspected as being the cause of bleeding but inspection with the nasopharyngoscope failed to show anything suggestive of malignancy or ulceration. The patient being very co-operative, a clear view of the nasopharynx could be had with the rhinoscopic mirror, but all that could be seen were patches of blood clot here and there, and these were not disturbed for fear of bringing on more bleeding. Careful digital examination of the postnasal area failed to disclose the presence of any tissue abnormal to touch.

We now had a negative Wassermann report and urine reports had shown nothing abnormal.

There had been a definite downward trend in the hemoglobin percentage and the red cell count. For example, on April 6 hemoglobin was 50 per cent; red cells, 2,700,000, with a white cell count of 5,150, and C. I., 1.09.

Up to this time we had no definite idea as to cause or location of bleeding point or points. On April 9, after a period of between five and six days of freedom from bleeding, I was again called on account of copious hemorrhage. I may say that it required anywhere from half an hour to more than an hour to arrest bleeding. During the time between the application of measures to control bleeding, the nurse attempted to collect in a basin the blood coming from the nose or mouth, and from calculations based on the amount of blood thus collected, it would appear conservative to say that from 100 cc. to more than 200 cc. were lost during each active bleeding.

At this time Dr. Tocantins suggested the use of freshly prepared thromboplastin applied locally. This was tried for two days without marked benefit. Ligation of the arterial supply of the nose was considered, only to be abandoned for the reason that we were not sure which arteries to ligate, since the sphenopalatine is a terminal branch of the external carotid, and the posterior and anterior ethmoidal arteries come from the internal carotid by way of the ophthalmic artery. As we now suspected that blood came from both sides of the nose, the futility of attempting ligations becomes evident.

On April 10, bleeding having recommenced some 12 or 15 hours after the last packing, it was decided to give blood transfusions, and 500 cc. were given by the indirect method on April 11. The same quantity was given at two-day intervals until six transfusions had been given.

What of the blood picture at this time? On April 15, hemoglobin was down to 29.6 per cent; red cells, 1,840,000; white cells, 4,900; platelets, 326,000; prothrombin, 94 per cent.

Dr. Tocantins now reported — 18 days after first bleeding — as follows: "Hematological examination does not disclose

any evidence which would account for the excessive bleeding from the nose. There is pronounced anemia which is evidently due to loss of blood. The negative history for tendency to bleed is against a constitutional defect. The bleeding is very likely due to erosion of a large vessel near the posterior nares. The history of allergy presents the possibility of polyps."

While X-ray studies of the sinuses and adjoining areas had been considered, the patient's condition had been so poor and the possibility of severe bleeding coming on during the process of moving him to the X-ray room so great that it was not until April 16 that this was successfully accomplished.

Dr. Kornblum reported on this examination as follows: "Examination of the paranasal sinuses shows a large, soft tissue mass that appears to be in the region of the sphenoid sinuses. There is marked clouding of the ethmoid region and the nasal chambers on both sides. There is some increased density in the region of the right frontal sinus. In the left frontal sinus there appears to be a fluid level. Examination of the skull with special reference to the sella turcica shows no abnormality involving this structure. Aside from the changes previously noted, the skull is negative. I strongly suspect this patient has a neoplasm — probably a carcinoma originating in the sphenoid sinuses, with extension to the ethmoid region on both sides."

This report was enlightening but not particularly comforting; however, the report states that a neoplasm was only suspected. Might it not be that the shadows seen in the sinuses and nasal chambers were due to blood clots in these areas? It seemed possible that before clotting, blood may have entered the sinuses through the normal ostia and later clotted within these cavities. There were points in favor of the idea; for instance, at one time for a period of two or three days blood appeared at the inner canthus of each eye. Apparently it had forced its way upward through the nasolacrimal duct. Another item was the absence of pain in the sinus region and the absence of any nerve disturbance of any cranial nerve which would be affected by the presence of a malignant growth in the nasal or postnasal area.

Any attempt at radical operative procedure would have been out of the question unless the main arterial supply was cut off, and to do this we again faced the probable necessity of ligating both common carotids. It was decided to continue along conservative lines for the time being.

While I had always been able to arrest active bleeding by careful placing of packing saturated with different solutions calculated to promote coagulation, bleeding always reappeared after a few hours. Clearly, this sort of thing could not go on indefinitely. The patient was becoming very impatient and discouraged. I felt something else must be tried. On April 18 I saturated the pack with a saturated solution of tannic and gallic acid in alcohol. There was much less bleeding during the next two days, after which it again appeared to be definitely arrested. The nose was not packed again after April 21. This was 24 days after the first bleeding had occurred, and there had been hemorrhage one or more times on 19 of the 24 days.

On April 19, both nasal passages being free from packing and clots, the first really satisfactory examination could be made. Using the nasopharyngoscope, I noted nothing abnormal, either in the nasopharynx or at the left posterior choana; however, high up under the roof the left naris and about 75 mm. anterior to the choana could be seen what appeared to be a very small polyp, about 3 mm. in length. Nothing of the sort could be seen in the right naris at this time, although three days later a similar but smaller mass was seen in the same location on this side.

For the first time, then, something definite had been found which might have some causative relation to the epistaxis. These polypoid masses were at some distance from the sphenopalatine arteries in the beginning of their course through the nose, but were undoubtedly in close relation to the posterior ethmoidal vessels as they enter the nasal cavity. Based on this observation, I believe the bleeding did have its origin in the ethmoid arteries of both sides; however, I can offer no proof that such was the case.

Regarding the cause of bleeding, it now seemed probable that polypoid changes had so weakened the vessel walls that rupture took place. On the other hand, nothing was done in

the way of removing the polypoid tissue; so, why did bleeding stop?

The final blood transfusion was given on April 20. The patient was kept in bed until April 25 and, there being no further bleeding, he was allowed to leave the hospital on April 27. He lost 20 pounds in weight during this experience.

To review briefly some of the observations made in this case:

There had been no operation or accidental injury preceding onset of bleeding. No abnormal condition of the blood was found which might have brought on bleeding. The circulatory mechanism was functioning normally. Although there was a history of hay fever during the past 10 years, there were no active manifestations of this condition during the period of bleeding. The prothrombin content of the blood was not materially lowered at any time. Clotting and bleeding times were never beyond the normal.

While bleeding could be expected in the presence of a malignant growth involving the nares or paranasal sinuses, we would also expect some pain and possibly disturbance of cranial nerves passing through or near the involved area. This patient did not complain of pain or nerve disturbance.

We have been able to make some further observations since the patient left the hospital.

On May 28 a series of pollen skin tests were made which demonstrated marked sensitivity to ragweed. There had been no bleeding since leaving the hospital.

Patient was next seen on Sept. 19, approximately four and one-half months after cessation of bleeding. He was enjoying excellent health except for some discomfort from his allergic condition. He had regained 15 pounds of the 20 pounds lost while in the hospital.

The polypoid mass in the left naris was larger, being about 0.5 cm. or more in length. The slightly smaller mass could still be seen in the right naris. These masses were not large enough to interfere with free nasal respiration. There was no exudate, no odor, and there had been no bleeding. Blood pressure at this time was 130 over 90. Patient refused

removal of a portion of polypoid mass for histological study, fearing a renewal of bleeding.

A second X-ray study was done by Dr. Kornblum on Nov. 15 and the following report made:

"There has been a very marked improvement in the appearance of the paranasal sinuses since our previous examination. The soft tissue mass found in the region of the sphenoid sinus has disappeared. There remains, however, some residual clouding of the ethmoids and sphenoids. The other sinuses are negative. A lateral and posteroanterior view of the skull are also negative.

"Interpretation: Moderate clouding of both ethmoid and sphenoid sinuses. No evidence of neoplasm at this time."

The final examination of this patient was made today, Dec. 3, 1940. Patient is perfectly well except for continued attacks of sneezing from this season's hay fever. He has gained another five pounds since previous examination; thus, he has regained all the weight lost while in the hospital.

The polypoid masses are still to be seen in the nares and are slightly larger. Seven months have now elapsed since the last bleeding. Even so, one should not be too optimistic as to future developments.

1429 Spruce Street.

REVIEW OF RECONSTRUCTIVE SURGERY OF THE FACE — 1940-1942.*

LIEUT.-COL. JAMES BARRETT BROWN, M.C., U.S.A., and
DR. FRANK MCDOWELL, St. Louis.

This paper is concerned with the literature between October, 1940, and April, 1942. Since our last review, a few new procedures have been published, but most of the articles have described further experiences with either standard or previously described operations. Ivy and Miller³⁶ have reviewed the literature for 1940 and Davis²⁴ and Seltzer⁶⁰ have depicted the history of plastic surgery.

FACIAL INJURIES.

As might be expected, the current war situation has stimulated interest in the care of facial injuries. Too little time has elapsed since our entry into the war for the appearance of many articles by American authors dealing with actual experiences with wounds in modern mechanized warfare. Necessarily, most of the papers deal with experiences 25 years ago, hypothetical procedures, or with methods which have been found useful in the care of facial injuries in civil life. Judging from McIndoe's⁵⁰ figures, the latter might be the most applicable, using any necessary alterations to meet the exigency of the situation. In England and with the British army, he found that more than half of the facial injuries were the result of airplane, automobile, tank and motorcycle crashes and from the collapsing of buildings, from which one might conclude that they would be roughly comparable to civilian injuries. Somewhat less than half were caused by bomb and mine explosions or penetrating missiles and might present peculiar problems all their own. He noted that most of the injuries were quite severe, 70 per cent of the lower jaw fractures being double, multiple or comminuted, and 12 per cent eventually requiring bone grafts. It might be inferred from this that many of the injuries will tax the ingenuity of even the most skillful operators and that rela-

*From the Department of Surgery, Washington University School of Medicine.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, May 18, 1942.

tively few of them will be amenable to essentially office procedures, either dental or surgical. such as the application of elastic bands between the teeth. He advocates conservatism in debridement and primary suturing of the soft tissues if seen within the first 12 hours, but not after 24 hours. Maxillary fractures were almost half as frequent as those of the lower jaw. He describes the use of the Kingsley splint for these, and also uses the plaster head cap for traction to hold up severe nasal or malar fractures.

Ivy and Stout³⁵ outline some plans for possible use by the American army, including an emergency splint made with three tongue depressors and adhesive with which to hold the lower jaw forward in severe injuries with collapsed airways.

Brown and McDowell⁷ describe a method for internal wire fixation of severe jaw fractures, drilling one or more rigid stainless-steel wires longitudinally through the mandible directly across each fracture line. It is thought to be a simple, direct method for fixation of the bone, eliminating the use of complicated dental appliances or wide open-reductions in the care of most severe injuries on their service. If there is no associated condyle fracture, the patient can open and close his mouth throughout the period of treatment.

Waldron and Balkin⁷⁸ illustrate a new "universal head cap and universal upper jaw splint" for holding up sagging maxillae.

Kazanjian³⁷ advocates early suturing of the soft tissues and immobilization of the bones and tries to break any long straight scars by the use of local zigzag flaps. He removes the teeth in the fracture line, and in edentulous jaws he usually does a direct suture of the bone fragments through the mouth.

Padgett⁵⁷ also advises early closure of the soft tissues and reduction of the bones. He notes that unless due care is used, the suture marks may be more embarrassing to the surgeon later than the scar and stresses the use of multiple fine sutures put in close to the wound edge. Badly depressed nasal fractures are elevated, transverse wires put through the fracture lines behind the bones and attached to a plaster cap overhead.

Strock⁷⁵ illustrates the use of intermaxillary rubber bands and Doherty reviews the treatment of jaw fractures, depicting Gilmer's method of interdental wiring. Blair³ describes the rôle of the plastic surgeon in the care of war injuries.

Lenormant⁴¹ states that the use of sulfamides in the treatment of war wounds was begun in the Third French army in September, 1939. Reviewing their experiences, he thinks that these drugs cannot be said to have brought about any revolution in the treatment but thinks that the results are so encouraging that their use should not be neglected. In his opinion, their use does not take the place of surgical treatment and wounds should be treated surgically just as in the past.

FACIAL PARALYSIS.

Most interest seems to be centered in the Duell-Ballance operation, free transplant of one of the femoral cutaneous nerves to the facial canal for paralysis following mastoid operations. Collier,¹⁷ Cooksey,²¹ Horgan,³¹ Hoover and Poppen³⁰ and Martin⁴⁷ report cases. Collier¹⁶ gives a good discussion of the limitations, and all of them note that the restored movement is one of mass action of most of the muscles on that side of the face, the term "synkinesia" being used to describe this phenomenon. This synkinetic movement may be of considerable or of very little use in the expression of emotions in individual patients. Facial tics or isolated purposeless movements have been noted about the chin, mouth and cheek. Nearly everyone agrees that the return of tonus to the muscles results in a good balance of the face when at rest; that sudden emotional expressions may result in exaggerated movements and even distressing grimaces, and that there is probably never any return in the frontalis. The same phenomena occur after repair by anastomosis of the XIth or XIIth nerve with the additional disability of paralysis of the shoulder or tongue. Hoover and Poppen³⁰ note that there may be vicarious movements such as closing the eye on sticking out the tongue or on swallowing, or pulling back the corner of the mouth when the shoulder is raised.

Collier points out that in most of the postmastoidectomy cases there is a whole segment of the nerve missing and that direct suture of the two ends is rarely possible. She also

notes that the immobilization afforded by the bony canal is essential for successful grafting and that grafts should not be attempted when the nerve has been interrupted outside the canal.

If there is any consensus of opinion, it seems to be that free nerve grafting should be attempted when the nerve is interrupted within the canal, and XIth or XIIth nerve anastomoses can be tried when the division is in the trunk but outside the canal. Attachment of the face to the temporalis muscle by fascial strips can be used in congenital paralysis, lesions below the first branching of the trunk, in imperfect results following any of the nerve operations, or in place of the XIth or XIIth nerve anastomoses in instances in which it is thought that the patient might object to the sudden mass movements of the face or the paralysis of the tongue or shoulder. Very few surgeons will agree with Horgan,³¹ who implies that all of the damage done by section of the facial nerve can be repaired.

Alexander¹ reports one case treated by Halle's operation of turning down three small flaps of temporalis muscle into the face, using a fish-hook incision from the temporal fossa down through the face to the nose. LeRiche⁴² notes that the lagophthalmos on facial paralysis is improved by sectioning the cervical sympathetic, and postulates an operation of sympathetic-facial anastomosis.

NOSE.

The treatment of the tip in plastic operations on the nose has been the subject of several of the recent papers. To elevate the tip, Converse¹⁸ cuts across the lateral crus of each alar cartilage just outside the dome and brings it up and sutures it to its fellow of the opposite side. For a tip that is too broad, some of the lateral crus is just taken out on each side, and for one that is too high, some of the medial crus is removed. He has noticed absence of considerable portions of the lateral crus in patients with collapsed nares and does a replacement with free cartilage transplants. For the latter condition, Gurney²⁰ undermines the skin over the entire tip through incisions just inside the nostril border and then transplants two small, long strips of rib cartilage clear across the lower end of the nose through an incision at the

junction of the nose and cheek. He warns that one should be careful that the patient does not object to an increase in the size of the nasal tip. Cinelli¹² describes the anatomy, physiology and pathology of collapse of the nares, including "functional collapse," which is treated by teaching the patient how to breathe properly. He has also divided and classified the muscles in and about the nose into alar dilators and constrictors. For atresia of the anterior nares, Cinelli¹² excises the web and inserts a split skin graft wrapped around a soft rubber tube which is left in place for 10 days.

From a very wide experience in doing secondary corrective operations, Safian⁶⁵ is able to point out many common errors in rhinoplastic surgery. These mistakes are well described and illustrated and the article will assuredly be of interest to anyone doing this type of work. Among other things, he notes that there is usually about 2 mm. or so of postoperative drooping of the tip, so that this amount of over-shortening can be done primarily; however, it is better to secondarily shorten the nose some than to over-correct it more than this amount at the original operation. He warns against removing so much from the posterior surface of the columella as to cause it to tend to disappear and points out that the correction of a hanging columella should be from the lower edge of the vertical crus. The Weir type of operation is indicated only in negroid nostrils and should be avoided whenever possible as it may obliterate the normal nasolabial fold.

Scher⁶⁶ reports a case in which he removed a nasal hump and transplanted it into the patient's receding chin. He also describes the occurrence of intranasal keloid, with thickening of the entire tip, following osteoplastic procedures. Some cases respond to early mild X-ray therapy and this may be used preoperatively in patients with a keloid history.

Straatsma⁷³ removed the nasal hump from a patient and transplanted it into a forehead defect. He also illustrates filling small alar losses by hinging down a tiny local flap for lining and putting on a free skin graft for covering.

Cohen¹⁵ treats saddle noses that are not too severely deformed by narrowing the nose and suturing the upper lateral cartilages together over the septum. A transplant can be added if necessary.

Wolf⁸⁰ reports a case of a nasal paraffinoma which was removed through an external incision from the glabella to the tip and the nose was then narrowed in the usual manner.

Moore and Harris⁵³ believe that one should be conservative in any debridement of a fractured nose. They pack vaseline gauze behind the depressed fragments and on the outside use a bandage roll on either side of the nose, held with adhesive, or dental wax, plaster, or a soft metal splint; a head band appliance may be added if necessary. Metzenbaum⁵² reduces the fractures, puts compressed cotton plugs inside, and adhesive tape, a copper splint, and an ice bag on the outside. The copper splint is removed the next day and just adhesive is used for the next week. In children, Salinger⁶⁴ immobilizes the nose with a copper splint which is fastened above to a starched head bandage and to the cheeks with adhesive.

Sparer⁷¹ has developed a hemostat type of forceps with triangular blades to be used in removing a triangle from one nasal bone in cases of marked lateral deviation. The forceps is put in through the usual pyriform recess incision and clamped on the bone, after which the bone is sawed through flush with each side of the blade of the forcep. Cinelli¹¹ has devised perforated guides for nasal saws, a punch to fracture the frontonasal suture line, and an alar cartilage forceps to hold it for trimming.

CARTILAGE AND BONE TRANSPLANTATION.

New and Erich⁵⁴ have suggested a method to prevent fresh costal cartilage grafts from warping. They put the cartilage in a test tube containing weak aqueous merthiolate and then place the test tube in a beaker of boiling water for 10 minutes. The cartilage is then removed and placed in cold saline for 15 minutes. During this process the cartilage apparently does a certain amount of warping and their studies indicate that transplants carved from material prepared in this manner do not undergo further changes in shape.

The interest in preserved cartilage seems to be waning somewhat, if the number of articles appearing is any criterion; however, Straith and Slaughter⁷⁴ seem quite enthusiastic about it and state that they have discarded the use of septal and aural cartilage and seldom use autotransplants

of rib cartilage. They review the present day theories regarding transplantation of tissues, including the individuality differential, the organ or tissue differential, and emphasizing the metabolic differential. They believe that one of the factors in the easy transplantability of autocardilage is its low metabolic rate and low production of possibly toxic metabolic products, and reasoning from this believe that a substance producing no metabolic products (*e.g.*, dead cartilage) should be even more readily transplantable. They also agree with others that most of the complications in nose transplants occur in patients with thick skins and enlarged oily pores. Iglauer³⁴ thinks that autocardilage is ideal but the necessity for a rib operation is the chief objection to it. He has used preserved cartilage in 22 cases which have been followed from one week to 21 months with satisfactory results.

Sheehan⁴⁰ believes that bone is better than cartilage because of the lack of curling and because it becomes attached to the facial bones by bony connections rather than by connective tissue. He prefers spongy to cortical bone because of its earlier vascularization and thinks that the inside and outside of the ilium are the best sources. Malbec⁴⁵ still uses ivory and prefers it to bone or cartilage; however, he states that none of his cases have been implanted more than three years, so he does not know whether they will be permanent.

Young⁴² has investigated the fate of autogenous rib-cartilage transplants in dogs and has found that they retain their size and weight and continue to have chondrocytes in the lacunae for as long as one and one-half years. He also chopped autogenous rib cartilage into fine pieces and seeded it over the sheath of the rectus muscle in dogs. He found that it remained viable and fused together into a solid sheet of opaque cartilage-like material, the fusion between the individual pieces being by fibrous tissue. The presence or absence of perichondrium seemed to make no difference in any of the experiments.

Peer⁴¹ investigated the fate of autogenous septal cartilage after transplantation into the subcutaneous region of the abdomen in humans. Eleven grafts were buried for periods up to three years and all lived without absorption; however, he found evidence that any nicks or indentations in the cartilage will become filled with connective tissue which may later contract or distort the graft.

SKIN GRAFTING.

The skin grafting of burns, including those of the face, will very likely be one of the greatest jobs of the plastic surgeon in warfare and there is a great deal of interest in it just now. Brown⁸ believes that everything possible should be done to make the work simple and direct and the addition of multiple names for already known and used grafts is merely adding confusion to the picture. Any graft which is the partial thickness of the skin is obtained by splitting the skin and for the sake of clarity might as well be called by the established term "split graft." If adjectives are desired to indicate its relative thickness it can be called a "thick split graft" or a "thin split graft." Padgett^{59,60} originally called a thick split graft cut with a dermatome an "intermediate" or "calibrated" graft and has more recently called it the "three-quarter" thickness graft. McPheeters and Nelson⁵¹ have sutured split grafts together before putting them on and have called the ensemble a "blanket graft." Marcks,⁴⁶ Horton³² and others vary towards the other extreme, cutting a split graft and dicing it up into small pinch grafts which they call "implantation grafts." Marcks has rather strongly recommended these grafts, advocating their use "regardless of the location and the cosmetic or functional result." Horton has even advocated their use on facial burns. Sheehan⁶⁸ has used thin split grafts inside the mouth, as many others have, but calls them "epidermic skin grafts." Koch⁴⁰ points out the undesirability of attaching proper names to grafts as it is very difficult to even ascertain the originator of each, George Lawson apparently first publishing the use of the full thickness graft and Ollier the split graft.

The technique of skin grafting has been described by Koch,⁴⁰ Converse,¹⁹ Brown and McDowell,⁸ and Padgett⁶⁰ has written a monograph on the subject. All have pointed out the desirability of grafting raw areas before contractures occur. Converse has brought up the almost forgotten subject of wide total excision of fresh burns and immediate skin grafting. This, of course, is applicable to small burns in the fleshy portions of the trunk or lower extremities, but obviously should not be used on the face.

Veal, Klepser and DeVito⁷⁷ have described the preparation of wounds for skin grafting by the local use of sulfanilamide,

and this was also mentioned by Converse and Brown and McDowell.⁸

Sheehan⁶⁸ has noted that split grafts to be used inside the mouth should be taken from relatively hairless areas and cut thin, so as to minimize the growth of hair and the secretion of sebum.

Brown and McDowell⁴ have followed patients who have had skin grafts through periods of growth up to 11 years and have noted that as children grow up the grafts either grow or stretch out, so that if enough skin was put in originally it usually suffices permanently. Occasionally a small amount of skin may have to be added later.

FACIAL REPAIRS.

May⁴⁸ illustrates a method of reconstructing the lower lip following its removal for carcinoma. The entire lower lip is excised down to the chin in a heart-shaped block and the new lip is made by swinging in a rectangular cheek flap from each side, with the pedicles along the lower border of the jaw, and suturing them together in the midline. Excess cheek mucosa is left attached to the upper border of each flap to be pulled over and form the new vermilion. The cheek defect on either side is closed in the form of an open Y.

Cunningham²³ reports a case in which he reconstructed most of the lower lip. The fornix was created with a free skin graft, and following this he turned half the thickness of the lip stump upward on itself to form lining and brought down a cheek flap to cover the outside.

Figi²⁷ reports a successful and extensive case in which he removed a tumor involving half the scalp and the adjacent temporal region down on to the face. The entire tumor was resected and the whole area was resurfaced at that time with free full thickness grafts. The grafts all took and gave quite a satisfactory result. Steiss⁷² had a patient with a malignant tumor of the scalp which he excised down through the periosteum and covered the defect by rotating a local flap. The flap bed was then covered with a free graft.

Young⁶¹ emphasizes the fact that persistent recurrent basal cell carcinomas of the face should be widely and radi-

cally excised and illustrates the repair of such defects with flaps and free grafts.

Douglas²⁰ reports five cases of X-ray and radium burns which were excised and covered with pinch grafts in three cases, split grafts in one case, and by jumping an abdominal flap via the wrist to the forehead in one case. Conway²⁰ reports 10 cases of the same which were excised and covered with some grafts but mostly flaps. Wilmoth¹⁹ reports a small X-ray burn of the neck which was excised and covered by using a large tubed chest flap. Another fire burn of the cheek was covered by using a jump flap from the lower chest via the wrist.

Hosmer, Burnham and Davis³³ describe a patient with a defect through the orbit and side of the nose which was covered by caterpillaring a tubed flap up from beneath the breast. Later, an iliac bone graft was transplanted beneath it and a prosthetic eye was fitted. May⁴⁰ discusses the correction of scars by excision, shifting of tissues, Z-plastics and grafts. Padgett⁵⁸ notes that he does contracted trap-door flaps in one stage, raising them completely, excising the underlying scar, resuturing them and putting on a pressure dressing which is left in situ for 10 days. He also illustrates late repairs following facial injuries, using flaps, grafts, cartilage and bone.

EARS.

Total and partial reconstructions continue to be of interest. Newman⁵⁶ shows two reconstructions of the upper portion of the ear, using a small costal cartilage for the framework, a split graft for the back, and a small tubed neck flap for the helix. He believes that they should not be attempted until the patient has reached full growth. Cox²² describes one case of helix reconstruction with a tubed neck flap and free grafts. Greeley²⁸ writes of reconstruction, using almost the whole of the mother's ear cartilage in children, and states that the maternal deformity is not so bad that the mothers object.

Lounsbury⁴⁴ describes a new small pressure clamp to be used in preventing "cauliflower" ears. The fresh hematoma should be aspirated immediately and the clamp applied for

48 hours, the procedure being repeated until no more fluid collects. The clamp is made from spring wire with sponge rubber pads to be applied over sterile gauze to the bleeding point.

CLEFT LIPS AND PALATES.

Ritchie⁸² considers the alveolar cleft to be a definite entity, as important or more so than the cleft in the lip or palate. He classifies all clefts into three groups, prealveolar, post-alveolar and alveolar, and discusses various methods of closing lips and palates.

Cinelli¹⁴ repairs the cleft lip nostril secondarily by removing the entire alar cartilage on the cleft side, reinserting it and suturing it to the one on the opposite side. A small piece from the septum is used as a free transplant over the dome of the alar cartilage on the cleft side to obtain more height. It is sometimes necessary to do a diamond excision in the floor.

Brown and McDowell⁵ describe the secondary repair of cleft lips and their nasal deformities. The repair of "whistling deformities," excessive scars, uneven vermilion, adherence to the lip of the alveolus, slumped and deviated noses, retrusion of the lip, and deformities resulting from ill-advised excision of the premaxilla and prolabium are discussed. Drawings are included showing the shifting of lower lip flaps to upper lips to restore proportion, the correction of deviated noses, the reconstruction of the lower lateral cartilages to obviate the slumped nostril, and the construction of a columella in double clefts to correct the snubbed tip of the nose. It is pointed out that most of these deformities are amenable to secondary correction, but certain ones are not, such as wide stay suture marks, and every attempt to avoid these should be made during the primary operation.

Cannon^{9,10} has introduced an interesting variation in the use of lower lip flaps for the secondary correction of retruded lips. He uses the midline Estlander vermilion-bordered flap but splits the distal end of it into two triangles, one of which is inserted into each nostril to produce more floor. The border scars of the flap somewhat simulate a philtrum.

MANDIBULAR OPERATIONS.

New and Erich²⁴ describe their method of correcting prognathism by bilateral resection of the second bicuspid or first molar regions with preservation of the nerves and blood vessels. They operate both inside the mouth and outside through the upper neck, removing a block of bone above and below the dental canal with a motor saw and chisels. The remaining bone is then carefully rongeured off of the nerve and artery and a small concavity is made in the stump to receive the nerve and artery when the jaw is set back. The jaw fragments are immobilized with specially made dental splints.

Kitlowski²⁰ removes a through and through block of bone in the same region and immobilizes the jaw by direct wiring through drill holes and also with a dental splint. In one case, the dental splint was so constructed that the patient could open and close his mouth throughout the period of convalescence. He noted that in his two cases, the sensation returned to normal in the lip in about three months.

MISCELLANEOUS.

Bettman² describes a case in which he constructed alveolar ridges in an edentulous upper jaw by transplanting small strips of rib cartilage beneath the mucoperiosteum on either side, the operation being done through openings within the mouth. The new alveoli served to prevent lateral motion of the upper denture. He also noted an instance in which he created a lower buccal fornix by using an inlay split graft wrapped around stent to form a tunnel which was later opened into the fornix.

Lewin⁴³ reports a rare condition known as anhidrotic ectodermal dysplasia with an accompanying marked shortening of the nose. He corrected it by cutting transversely completely through the nose just above the tip, pulling the tip down and filling in the defect with a tubed neck flap. Nasal skin was inverted for lining, and two pieces of preserved cartilage were implanted later for support.

Updegraff⁷⁶ discussed methods of wound closure to avoid prominent scars and stresses long-continued support of wounds postoperatively with adhesive.

Shanks⁶⁷ briefly describes various operations about the eyelids. Spaeth⁷⁰ writes of injuries about the orbit and advo-

cates the use of dental wax in the antrum to hold up depressed orbital floors after they have been elevated. He also notes that transverse lacerations through the cheek and lower lid are apt to produce notching of the lid later, and advises cutting zigzag flaps along either side and interdigitating them.

BIBLIOGRAPHY.

1. ALEXANDER, R. J.: Correction of Facial Paralysis by Muscle Transplant. *Rocky Mountain Med. Jour.*, 38:713, 1941.
2. BETTMAN, A. G.: Rebuilding the Alveolar Process and the Buccal Sulcus. *Am. Jour. Surg.*, 52:62, 1941.
3. BLAIR, V. P.: The Role of the Plastic Surgeon in the Care of War Injuries. *Ann. Surg.*, 113:697, 1941.
4. BROWN, J. B., and McDOWELL, F.: Persistence of Function of Skin Grafts Through Long Periods of Growth. *Surg., Gynec. and Obst.*, 72:848, 1941.
5. BROWN, J. B., and McDOWELL, F.: Secondary Repair of Cleft Lips and Their Nasal Deformities. *Ann. Surg.*, 114:101, 1941.
6. BROWN, J. B.: Thick Split Grafts in the Repair of Burns; Editorial. *Surg., Gynec. and Obst.*, 73:265, 1941.
7. BROWN, J. B., and McDOWELL, F.: Internal Wire Fixation for Fractures of Jaw: Preliminary Report. *Surg., Gynec. and Obst.*, 74:227, 1942.
8. BROWN, J. B., and McDOWELL, F.: Massive Repairs of Burns with Thick Split Skin Grafts: Emergency "Dressings" with Homografts. *Ann. Surg.*, 115:658, 1942.
9. CANNON, B.: The Split Vermillion Bordered Lip Flap. *Surg., Gynec. and Obst.*, 73:95, 1941.
10. CANNON, B.: The Use of Vermillion Bordered Flaps About the Mouth. *Surg., Gynec. and Obst.*, 74:458, 1942.
11. CINELLI, A. A.: New Instruments for Use in Rhinoplastic Surgery. *Arch. Otolaryngol.*, 32:1102, 1940.
12. CINELLI, A. A.: Nasal Atresias: A Surgical Critique. *Ann. Otol., Rhinol. and Laryngol.*, 49:912, 1940.
13. CINELLI, A. A.: Collapse of the Nares. *Arch. Otolaryngol.*, 33:683, 1941.
14. CINELLI, A. A.: Secondary Nasal Deformities Following Correction of Cleft Lip. *THE LARYNGOSCOPE*, 51:1053, 1941.
15. COHEN, S.: Plastic Surgery of the Nose. *THE LARYNGOSCOPE*, 51:363, 1941.
16. COLLIER, D. J.: Discussion on the Limitations of Operative Treatment of Facial Paralysis. *Proc. Roy. Soc. Med.*, 34:575, 1941.
17. COLLIER, D. J.: Facial Paralysis and Its Operative Treatment. *Lancet*, 2:91, 1940.
18. CONVERSE, J. M.: Corrective Surgery of the Nasal Tip. *Ann. Otol., Rhinol. and Laryngol.*, 49:895, 1940.
19. CONVERSE, J. M.: Early Skin Grafting in War Wounds of the Extremities. *Ann., Surg.*, 115:321, 1942.

20. CONWAY, J.: The Surgical Management of Post-Radiation Scars and Ulcers. *Surg.*, 10:64, 1941.
21. COOKSEY, F. S.: Discussion on the Limitations of Operative Treatment of Facial Paralysis. *Proc. Roy. Soc. Med.*, 34:580, 1941.
22. COX, G. H.: Surgery of the Auricle, Including Total Reconstruction and Protuberant Ears. *THE LARYNGOSCOPE*, 51:791, 1941.
23. CUNNINGHAM, A. F.: Reconstruction of Lower Lip. *Northwest Med.*, 39:336, 1940.
24. DAVIS, J. S.: The Story of Plastic Surgery. *Ann. Surg.*, 113:641, 1941.
25. DOHERTY, J. A.: Practical Points in the Diagnosis and Treatment of Fractures of the Jaws. *Surg., Gynec. and Obst.*, 72:96, 1941.
26. DOUGLAS, B.: The Treatment of X-ray and Radium Burns by Radical Excision and Grafting. *Jour. Tenn. Med. Assn.*, 34:220, 1941.
27. FIGI, F. A.: Extensive Mole of Face and Scalp: Excision and Full Thickness Skin Graft. *Proc. Staff Meet., Mayo Clin.*, 16:280, 1941.
28. GREELEY, P. W.: Reconstructive Otoplasty. *Surg.*, 10:457, 1941.
29. GURNEY, C. E.: Surgical Correction of Collapsed Alar Cartilages. *Arch. Otolaryngol.*, 33:199, 1941.
30. HOOVER, W. B., and POPPEN, J. L.: Surgical Repair of the VIIIth Cranial or Facial Nerve for Facial Paralysis. *Surg. Clin. N. Am.*, 1:685, 1940.
31. HORGAN, J. B.: A Case of Dual-Balance Nerve Graft for the Cure of Complete Traumatic Facial Paralysis. *Irish Jour. Med. Sc.*, 185:196, 1941.
32. HORTON, W. S. S.: Implant Skin Grafting. *Am. Jour. Surg.*, 55:597, 1942.
33. HOSMER, M. N.; BURNHAM, D. K., and DAVIS, A. D.: Osteomyelitis of the Bones of the Face in a Severe Diabetic; with Recovery and Plastic Reconstruction. *Cal. and West. Med.*, 53:164, 1940.
34. IGLAUER, S.: The Use of Preserved Human Cartilage in Reconstructive Facial Surgery. *Ann. Otol., Rhinol. and Laryngol.*, 50:1072, 1941.
35. IVY, R. H., and STOUT, R. A.: Emergency Treatment of War Injuries of the Face and Jaws. *Ann. Surg.*, 113:1001, 1941.
36. IVY, R. H., and MILLER, H. A.: Plastic Surgery, 1940. *Arch. Otolaryngol.*, 34:179, 1941.
37. KAZANJIAN, V. H.: Primary Care of Injuries of the Face and Jaws. *Surg., Gynec. and Obst.*, 72:431, 1941.
38. KERR, H. H.: Neurosurgical Aspects of Facial Injury. *Surg., Gynec. and Obst.*, 72:512, 1941.
39. KITLOWSKI, E. A.: The Surgical Correction of Mandibular Prognathism. *Ann. Surg.*, 115:647, 1941.
40. KOCH, S. L.: The Transplantation of Skin and Subcutaneous Tissue to the Hand. *Surg., Gynec. and Obst.*, 72:1, 1941.
41. LENORMANT, C.: The Use of the Sulfamides in the Treatment of Wounds. *Mem. Acad. de Chir.*, Paris, 66:883, 1940.
42. LERICHE, R.: Possibility of a New Surgical Procedure for the Treatment of Facial Paralysis. *Presse Med.*, 48:721, 1940.

43. LEWIN, M. J.: Nasal Deformity in Anhidrotic Ectodermic Dysplasia. *Arch. Otolaryngol.*, 35:210, 1942.
44. LOUNSBURY, J. B.: Treatment of Hematoma of the Ear by Means of a New Pressure Clamp. *Arch. Otolaryngol.*, 33:317, 1941.
45. MALHEC, E. F.: Fourteen Cases of Partial Rhinoplasty: Marble Prosthesis. *Semana med.*, 47:1173, 1940.
46. MARCKS, K. M.: The Use of Implantation Grafts in the Healing of Infected Ulcers. *Am. Jour. Surg.*, 51:354, 1941.
47. MARTIN, R. C.: Recent Experiences with Operation on the Facial Nerve. *Arch. Otolaryngol.*, 32:1071, 1940.
48. MAY, H.: Closure of Large Defects of Lower Lip and Chin. *Surg., Gynec. and Obst.*, 73:236, 1941.
49. MAY, H.: The Correction of Scars. *Am. Jour. Surg.*, 50:754, 1941.
50. MCINDOE, A. H.: Surgical and Dental Treatment of Fractures of the Upper and Lower Jaws in War Time. *Proc. Roy. Soc. Med.*, 34:267, 1941.
51. MCPHEETERS, H. O., and NELSON, H.: The Blanket Split Skin Graft for Covering Large Granulating Areas. *Jour. A. M. A.*, 117:1173, 1941.
52. METZENBAUM, M. F.: Recent Fracture of the Nasal Base Lines of Both Outer Nasal Walls with Divergent Displacement. *Arch. Otolaryngol.*, 34:723, 1941.
53. MOORE, P. M., and HARRIS, H. E.: Fractures of the Nasal Bones. *Am. Jour. Surg.*, 50:668, 1941.
54. NEW, G. B., and ERICH, J. B.: The Surgical Correction of Mandibular Prognathism. *Am. Jour. Surg.*, 53:2, 1941.
55. NEW, G. B., and ERICH, J. B.: A Method to Prevent Fresh Costal Cartilage Grafts from Warping. *Am. Jour. Surg.*, 54:435, 1941.
56. NEWMAN, J.: Reconstruction of the Ear. *Surg., Gynec. and Obst.*, 73:234, 1941.
57. PADGETT, E. C.: Severe Injuries of the Face and Jaws. *Am. Jour. Surg.*, 51:829, 1941.
58. PADGETT, E. C.: The Late Care of Severe Injuries of the Face and Jaws. *Surg., Gynec. and Obst.*, 72:437, 1941.
59. PADGETT, E. C.: Skin Grafting and the "Three-Quarter" Thickness Skin Graft for Prevention and Correction of Cicatricial Formation. *Ann. Surg.*, 113:1035, 1941.
60. PADGETT, E. C.: Skin Grafting. The Charles C. Thomas Co., Springfield, Ill., 1942.
61. PEER, L. A.: Fate of Autogenous Septal Cartilage After Transplantation in Human Tissues. *Arch. Otolaryngol.*, 34:696, 1941.
62. RITCHIE, H. P.: Congenital Clefts of the Face and Jaws. *Surg., Gynec. and Obst.*, 73:654, 1941.
63. SAFIAN, J.: Failures in Rhinoplastic Surgery: Causes and Prevention. *Am. Jour. Surg.*, 50:274, 1940.
64. SALINGER, S.: Injuries to the Nose in Children. *Arch. Otolaryngol.*, 34:936, 1941.
65. SCHER, S. L.: The Deformed Nose. *Arch. Otolaryngol.*, 34:307, 1941.

504 BROWN & MC DOWELL: FACIAL PLAS. SURG., 1940-42.

66. SELTZER, A. P.: History of Plastic Surgery. *THE LARYNGOSCOPE*, 51:256, 1941.
67. SHANKS, J.: Ophthalmic Plastic Surgery. *Med. Rec.*, 152:408, 1940.
68. SHEEHAN, J. E.: Application of Epidermic Skin and Mucous Membrane Grafts to Congenital and Acquired States. *Med. Rec.*, 152:404, 1940.
69. SHEEHAN, J. E.: The Use of Iliac Bone in Facial and Cranial Repair. *Am. Jour. Surg.*, 52:55, 1941.
70. SPAETH, E. B.: The Immediate and Late Treatment of Injuries About the Orbit. *Surg., Gynec. and Obst.*, 72:453, 1941.
71. SPARER, W.: Simplified Method of Removing a Triangular Wedge of Nasal Bone in the Plastic Correction of Lateral Deviation of the Nose. *Arch. Otolaryngol.*, 33:666, 1941.
72. STEISS, C. F.: Reconstruction of the Scalp Following Excision of Malignancy. *Am. Jour. Surg.*, 52:378, 1941.
73. STRAATSMA, C. R.: Some Problems in Nasal Plastic Surgery. *THE LARYNGOSCOPE*, 50:1092, 1940.
74. STRAITH, C. L., and SLAUGHTER, W. B.: Grafts of Preserved Cartilage in Restorations of Facial Contour. *Jour. A. M. A.*, 116:2008, 1941.
75. STROCK, M. S.: Fractures of the Mandible. *Surg., Gynec. and Obst.*, 72:1047, 1941.
76. UPDEGRAFF, H. L.: Wound Closure, with Particular Reference to the Avoidance of Scars. *Am. Jour. Surg.*, 50:749, 1941.
77. VEAL, J. R.; KLEPSE, R. G., and DeVITO, M. P.: The Preparation of Superficial Wounds for Skin Grafting by the Local Use of Sulfanilamide and Sulfanilamide-Allantoin Ointment. *Am. Jour. Surg.*, 54:716, 1941.
78. WALDRON, C. W., and BALKIN, S. G.: Fractures of the Maxilla. *Surg.*, 11:183, 1942.
79. WILMOTH, C. L.: The Tubed Pedicle Graft in Facial Reconstruction. *Am. Jour. Surg.*, 53:300, 1941.
80. WOLF, G. D.: Paraffinoma of the Nose. *Am. Jour. Surg.*, 55:152, 1942.
81. YOUNG, F.: The Treatment of Persistent Recurrent Basal Cell Carcinoma of the Face. *Surg., Gynec. and Obst.*, 73:152, 1941.
82. YOUNG, F.: Autogenous Cartilage Grafts. *Surg.*, 10:7, 1941.

400 Metropolitan Building.

IN MEMORIAM

CORDIA C. BUNCH, Ph.D.

We announce with regret the sudden death of Dr. Cordia C. Bunch on Sunday, June 14, at Hart, Mich. He was 57 years old.

Dr. Bunch received his A.B. degree from Iowa State Teachers College in 1916; his M.A. from the State University of Iowa in 1917; his Ph.D. in Physics from the latter university in 1920, and was Research Assistant, Assistant Professor and Associate Professor in Otology between 1918 and 1925. During this time he was associated with Dr. Lee Wallace Dean, working on the development of the modern audiometer.

In 1927, Dr. Bunch left the University of Iowa and went to Johns Hopkins University, where he was Research Associate and Associate Professor in Research in Otology.

Appointed Professor of Applied Physics in Otolaryngology at Washington University July 1, 1930, he served in that capacity until July 1, 1941. During his period in St. Louis he was active in the postgraduate courses in otolaryngology and stimulated the interest of the students in problems of deafness, the audiometer and hearing aids.

From 1937 to 1939 he was associated with Dr. Max A. Goldstein at Central Institute for the Deaf and for a time was associate editor of *THE LARYNGOSCOPE*.

In 1941, he left St. Louis and became affiliated with Northwestern University in Chicago.

Dr. Bunch was made an Honorary Fellow of the American Otological Society, Inc., in 1931, in recognition of his outstanding work in audiometry.

His loss will be deeply felt by his many friends and his colleagues in otology.

He is survived by his widow, to whom we extend our sincere sympathy.

T. E. W.

DR. DAVID BRYSON DELAVAN,

1850-1942.

Dr. D. Bryson Delavan, distinguished otolaryngologist of New York City, died at home May 23, at the age of 92 years.

Graduating from Yale University in 1872 and from the College of Physicians and Surgeons, Columbia University in 1875, he served an 18 months' internship at Charity Hospital, Welfare Island (now City Hospital), where he helped establish a special ward for laryngeal diseases, one of the first of its kind in this country.

Dr. Delavan was Professor of Laryngology and Rhinology at New York Polyclinic Medical School and Hospital in 1887 and later was Surgeon, Trustee and Board Member until 1918.

At the time of his death he was President of Russell Sage Institute of Pathology and of the Medical Board of St. Luke's Home. He maintained an active interest in the New York Academy of Medicine, organizing its Section on Laryngology in 1886.

In 1915, Dr. Delavan was the first to suggest the use of radium in the treatment of cancer of the throat. In his fight against diphtheria he introduced the successful treatment of "carriers" by disinfecting the throat with the Dakin-Dunham Solution.

Dr. Delavan was a Fellow of the Royal Society of England, Corresponding Fellow of the British Laryngological Association, former President (1893 and 1928) of the American Laryngological Association, being presented with that Society's gold medal as "Dean of American Laryngologists" in 1931, the fiftieth anniversary of his election to Fellowship. He also served as President of the New York Pathological Society, the Grenfell Association of America and the Scenic and Historic Preservation Society of America.

In spite of his advanced years Dr. Delavan's interest in his specialty continued, and he was to have presented a paper at the Sixty-fourth Annual Meeting of the American Laryngological Society, which opened in Atlantic City on May 24.

In 1899, Dr. Delavan married Miss Marion Rumsey, of St. Louis, who died in 1938. He is survived by his daughter, Mrs. William Randolph Moore, Jr.

L. G.

